THE

ANATOMY OF THE BRAIN,

WITH

SOME OBSERVATIONS ON ITS FUNCTIONS.

By ALEXANDER MONRO, M.D. F.R.S.E.

&c. &c. &c.

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from his friend
friend the Author

THE

ANATOMY OF THE BRAIN,

WITH SOME OBSERVATIONS ON ITS FUNCTIONS.

By ALEXANDER MONRO, M. D. F. R. S. E.

PROFESSOR OF ANATOMY AND SURGERY IN THE UNIVERSITY OF EDINBURGH.

TO WHICH IS PREFIXED AN ACCOUNT OF EXPERIMENTS ON THE WEIGHT AND RELATIVE PROPORTIONS OF THE BRAIN, CEREBELLUM, AND TUBER ANNULARE, IN MAN AND ANIMALS, UNDER THE VARIOUS CIRCUMSTANCES OF AGE, SEX, COUNTRY, &C. BY SIR WILLIAM HAMILTON, BART.

ILLUSTRATED BY COLOURED ENGRAVINGS.

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TO

DR WILSON PHILIP, F.R.S.L. & E.

WHOSE BRILLIANT DISCOURSES

HAVE THROWN SO MUCH LIGHT ON THE FUNCTIONS

OF THE NERVOUS SYSTEM,

THE FOLLOWING PAGES

ARE MOST RESPECTFULLY INSCRIBED,

BY HIS SINCERE FRIEND

THE AUTHOR.

INTRODUCTION.

In the following pages, a description is given of the Brain, to which neither alcohol nor boiled oil had been applied.

By permission of my much esteemed colleague Sir William Hamilton, an abstract of his new and valuable discoveries respecting the weight of the Brain, and the proportion of its component parts in man and various of the inferior animals, is prefixed.

There are two sources from which a knowledge of the functions of any part may be discovered, viz. by making experiments on living animals, or by noting the symptoms associated with a morbid state of the part. The latter of these modes has been adopted; a number of cases illustrative of the effects of external injury, or disease on the brain and its membranes, has been subjoined: thus a mass of evidence is presented shewing the many difficulties which beset this inquiry.

The principal functions of the brain are, sensation, voluntary motion, and the various manifestations of mind. In the organic derangements of the brain, these functions are more or less disturbed; a patient loses sensation, voluntary motion, and thought, or he is attacked by *spasm* or *convulsion*, or by a certain degree of *mental aberration* or *mania*.

The mental operations are intimately connected with the convolutions of the brain and cerebellum, the corpus callosum, corpora striata, thalami, and tuber annulare, which are much developed in man: whereas sensations and voluntary motions are chiefly connected with the corpora quadrigemina, vermiform processes of the cerebellum and the spinal cord, which are proportionally smaller in the human species. The experiments and observations which have recently been made upon the brain, confirm the remarks of my Father as to the use of the large size of the hemispheres of the human brain.

"The human brain greatly exceeds in proportional "size the brain of other animals of the same class. "Hence we are led to consider the brain as a medium "between the mind and the rest of the body of the

" animal, by the intervention of the machinery of " which the intellectual powers are influenced *."

My much esteemed friend and colleague Dr ALISON, in his valuable Outlines of Physiology, has observed, " On the whole, the only point ascertained is, the general appropriation of the great mass of the hemisphere of the brain proper, to acts of thought, which is by no means peculiar to, and does not derive its chief support from, the writings of phrenologists †."

In modern times, much pains have been taken to discover the uses of particular portions of different parts of the brain and cerebellum, in order to establish a diagnosis as to the seats of their diseases, to enable the physician to determine whether the membranes or substance of the brain be inflamed, what is the seat of effused blood or water, or of a tumour.

Such investigations are praiseworthy, and of peculiar interest, being calculated, if successful, to improve

* Vide MONRO's Observations on the Structure and Functions of the Nervous System, p. 26. Edin. 1783.

† Vide Outlines of Physiology, p. 309.

our knowledge of the physiology and pathology of the brain and cerebellum; but I freely confess that, in my opinion, little progress has as yet been made in this difficult inquiry; and, in proof of my allegation, the reader is referred to the subjoined cases, which are arranged according to the part affected; those of the membranes form the first class; those of the upper part of the hemispheres the second; those of the anterior lobes of the brain the third, and so on.

From these it appears that, in consequence of external injury or disease, the brain is liable to inflammation, the effusion of serum, lymph, gelatine, and blood upon its surface, or into its substance. It is also occasionally softened or hardened generally, or partially. Abscesses of different sizes not unfrequently form within it, and a part of it is sometimes destroyed by ulceration; the brain is also liable to be compressed by bony projections, and different kinds of tumours. There are many causes which render the diagnosis of particular diseases of the brain very difficult. With the exception of general inflammation, by which all its functions are deranged, the symptoms of the diseases are not essentially different from one another. Hence they cannot, during life, be with certainty discrimina-

ted; and, even regarding the general inflammation of the brain, it may be observed, that the patient falls so speedily into a state of coma, that he can give no account of the malady with which he is afflicted. Thus the peculiar symptoms of the inflammation are rendered very obscure from the suspension of the sensorial functions. Coma is not a symptom peculiar to any one morbid affection of the brain, but common to several, and even to those of an opposite nature. Another cause of obscurity is the great variety in the degree of the inflammation. It is sometimes so extremely acute, and proves so speedily fatal, as to occasion but slight disorganization of the brain; though, at other times, more especially in scrofulous constitutions, it is of a very low grade.

Partial inflammation of the brain produces, in some cases, a small and fluttering pulse, and low delirium; but, in others, a hard and wiry pulse, and violent delirium. According to Dr ABERCROMBIE, there is a form of inflammation of brain "in which the pulse scarcely exceeds the healthy standard, and is frequently about sixty. The pain is usually deep seated, and very acute, and is referred to various parts of the head; frequently it seems to shoot from temple to temple, and sometimes

is referred to the ear. There is a look of much oppression, and in some cases vomiting; delirium frequently appears at an early period *."

There are other sources of difficulty in discriminating between the peculiar diseases of the brain. 1st. In consequence of the occasional and rapid conversion of one disease of the brain into another,—thus palsy and mania sometimes follow apoplexy, syncope convulsions; 2d, Owing to the remarkable sympathy between the brain and other parts of the body,—thus pain in the belly, is often the primary and most marked symptom of the effusion of water within the brain; 3d, Owing to the co-existence of two very different diseases of the brain,—thus tumours of the brain, by impeding the free return of venous blood to the heart, very often occasion an effusion of water within the head.

It must be at the same time remarked, with regard to the effusion of serum, which has been usually said to give rise to coma, that I have repeatedly seen several

* Vide Abercrombie on Diseases of Brain, p. 13, 2d edition.

ounces of water within the ventricles of the brain, though there had been no symptoms of its presence *; and I agree with Dr ABERCROMBIE in thinking, "that we have no certain mark which we can rely upon as indicating the presence of effusion in the brain. Slowness of pulse, followed by frequency, squinting, double vision, dilated pupil, paralytic symptoms, and perfect coma, we have seen exist without any effusion."

The difficulty of detecting, by the symptoms, the site of effused blood has been universally acknowledged; and, according to SŒMMERING, every part of the brain has been injured, without a corresponding injury of its functions †; and there is no less uncertainty as to the diagnosis between concussion and compression of the brain, and more especially as the symptoms of these very different states often co-exist.

Organic diseases of the brain may be confounded with commotion of that organ, which sometimes gives rise to complete or partial loss of vision and hearing, or to partial palsy, as of the muscles supplied by the

* Vide Treatise on Morbid Anatomy of Brain.

† Vide vol. iv. De Fabric. Corporis Humani.

portio dura of the seventh pair of nerves. Our imperfect knowledge of the functions of the brain, is obvious from the consideration of many well-authenticated cases of its ossification, which have been published by SCARABICIUS*, SIMSON †, and others ‡; and the still more remarkable and indubitable example of the total absence of the cerebellum in a girl of twelve, which occasioned no apparently adequate symptoms, is even a stronger instance of our ignorance of the function of this part of the nervous system §.

It appears from the annexed cases, that some parts of the brain are double, and that a particular part of

* Eph. Curios. Nat. Dec. i. p. 92. 289. Appendix, p. 8.

† Vide Inquiry how far the Vital and Animal Actions are independent on Brain. Edinburgh, 1752.

‡ Vide Archiv. Gever. for 1831.

§ Vide GIRO, Gaz. de Sante, Paris, Nov. 11. 1809. It has been stated, that the above cases were not examples of ossification of the brain, but of exostoses growing from the skull. Whether such an opinion be correct or not admits of doubt. I have had occasion to see two instances in which a mass of bone as large as a billiard-ball was lodged within the substance of the brain; and also a case (described in my Morbid Anatomy of Brain), in which considerable ossification was found in the very centre of a large cartilaginous tumour, which was imbedded in the substance of the brain.

it may be disorganized or absorbed, providing the same disease does not affect the brain generally. Hence abscesses, tumours, and coagula of blood do not invariably derange its functions, or give rise to characteristic symptoms. When pressure on the brain gives rise to symptoms, their urgency depends upon the period of life of the individual, and upon the sudden or slow manner in which pressure is applied. Thus the infant's head is frequently much compressed during its passage through the small or deformed pelvis of the mother, and yet no bad consequences ensue; but, by the sudden application of pressure, with compression from extravasated blood, as in severe cases of concussion of the brain, or blow upon the head, the brain is instantly so much affected, that the heart and bloodvessels cease to act; whereas, in the milder degree of concussion, the mechanism of the brain is not destroyed; the sensibility is diminished; the heart acts feebly and irregularly; but, after the lapse of a few hours, the state of collapse goes off, and the heart and bloodvessels recover from the shock they have sustained, and the sensibility returns. Further, the symptoms of pressure disappear upon the compressing cause being removed, and even though it be not removed, for several weeks. If compression of the brain be occasioned

by a fractured and depressed portion of the skull, it produces its effects immediately ; but some time elapses before effused blood produces morbid symptoms, as the effusion is generally gradual, and does not give rise to any bad consequence until the effusion is considerable.

As the brain of the adult is enclosed in an unyielding bony case, the enlargement of any one part must occasion general pressure of the whole, unless a quantity of sound brain, equal in bulk to the diseased, be removed by absorption, or a part of the skull be elevated above the general level, or a portion of brain protruded through an aperture in the skull; or, as rarely happens, when the component bones of the skull are disjoined. By these different means, the effects of the pressure are avoided, and an acute is converted into a chronic disease.

The upper part of the brain is insensible. In a number of examples of compound fracture of the skull, the brain has protruded without occasioning any obvious pain, and without being followed by any degree of lesion of the mental faculties *. There are several

* Mr Brodie observes, " The patient may go on from day to day with fresh portions of the brain oozing out of the aper-

instances in which musket bullets have been lodged within the brain for several years, without giving rise to headach, or any one bad symptom, and in which the ball has been discovered in the substance of the brain after death *; and it is proved by the subjoined cases that a considerable portion of the upper part of the hemispheres, or of the middle lobes, may be removed without giving rise to any peculiar symptoms †.

ture in the cranium, with his external senses perfect, his mental functions unimpaired, and free from paralytic affection."—Vide Med. Chir. Trans. of London, vol. xiv.

* I was acquainted with a Major in the Army, who had been wounded in the head by a musket bullet; the ball remained within the brain, and created no uneasy sensation whatever. I had occasion to examine an instance in which a pistol ball was lodged near to the base of one of the hemispheres, in a sac formed by effused lymph.

† Above two years ago, I saw, in the garden of Sir William Hamilton, several young rabbits and chickens, to all appearance in the most perfect health, through whose brains and cerebella wires, small skenes of thread, &c. had at different times been passed in various directions; and Sir William assured me (what was indeed the condition of his experiments) that the animals do not seem to suffer pain at the time the needles, &c. are passed, with exception of the slight smart in puncturing the integuments. The brain has been long known to be wholly insensible. His experiments, he tells me, prove,

According to Sir CHARLES BELL and MAGENDIE, sensibility is immediately connected with the second

that if the great bloodvessels are avoided, and a perforating instrument of too great a diameter be not employed, the brain (basilar no less than coronal region), nay, what is still more remarkable, the cerebellum may, without pain, or inflammation, or ramollisement, and, with exception of a very limited focus, without apparent injury to the vital functions, be almost literally made a pin-cushion. Though not a medical man, Sir WILLIAM thinks, that if the cerebral non-irritability of the smaller animals holds good in man, which we have little reason to doubt, and if the larger calibre of his bloodvessels do not oppose an impediment, a permanent and gradual drain, in cases of hydrocephalus, may, without any danger, be obtained by passing a cannula, of a particular construction, and with lateral perforations, through the ventricles. By this means, in *acute* hydrocephalus, the sudden pressure of the water, which is probably in most cases the proximate cause of death, would be taken off, and time allowed for the morbid diathesis, or the obstruction, to abate; in *chronic* cases, the further accumulation of fluid would be prevented, and, by the gradual evacuation of that already collected, which could easily be regulated, combined perhaps with gentle pressure, the brain and cranium might be safely restored to their natural relations. To pass a wire, corresponding to such a cannula, from side to side, through the middle or lower part of the ventricles, he found to be an operation absolutely *of no danger whatever* in the smaller animals—as yet, he has tried it in none larger than the cat. In the substance of the brain the foreign body is in a few days surrounded by a toughish sheath of coagulable lymph; adhesion of this to a wire or cannula is prevented by occasionally turning them. In a great

part of the fifth pair of nerves, and the posterior parts of the spinal nerves. MAGENDIE observes, " It is not then in the brain proper, nor in the cerebellum, that the principal seat of sensibility, or of the *species senses*, is placed *.

The most important portions of the brain, on which the secreting and assimilating processes chiefly depend, are placed at its base, the place of the greatest security, where they are least exposed to suffer from external injury. Injuries at the base of the brain generally have proved fatal. There are, however, exceptions to this general rule; thus BAGIEU, VALERIOLA, have recorded examples † in which a ball entered the base of the brain, and came out at the upper part of the head. A most striking case has been published by BRIOT ‡, in which a bayonet entered the

many experiments (without a single accident) Sir WILLIAM never found that such a perforation produced any apparent effect; and several animals (quadrupeds and birds), continued to exhibit for years the highest health and vigour, with all their instincts, whose heads were transfixed by sundry substances in this and other directions.

* Vide Translation by Dr MILLIGAN, 4th edit. p. 111.

† Vide SABATIER's Med. Operat. tom. ii.

‡ Hist. de l'Etat et des Progress de la Chir. Milit. Besançon, 1817.

right temple two inches above the orbit. It inclined downwards, and passed through the maxillary sinus of the opposite side, and projected above five inches. The patient was cured in three months, but with the loss of the right eye.

The last circumstance meriting notice respecting the concomitant symptoms of wounds or diseases of the brain is a very extraordinary one, and of difficult explanation, viz. that a disease or injury of a certain part does not invariably give rise to the same symptoms.

Thus in several of the subjoined cases, a disease of the thalami nervorum opticorum impaired to a greater or less degree the vision; but in the case No. 81, though the surfaces of the corpora striata and thalami optici were torn up, lacerated, and destroyed, yet *the sight was not in the slightest degree impaired:* and it appears from the annexed cases, that there was no uniformity as to the symptoms of the various diseases of the cerebellum. The cases related by MORGAGNI * and Dr HENNEN †, afford additional evidence of the above fact. In the first of these cases, a sharp instrument passed

* Letter. † Military Surgery.

between the eye and roof of the orbit, and penetrated the brain nearly as far as the lateral ventricle. In the second, an iron ramrod entered below the nasal process of the frontal bone, and passed into one of the anterior lobes of the brain. In the former case, though the wound was deeper, no bad consequences followed until suppuration began on the third day, but the latter *instantly proved fatal.*

From several of the annexed cases, it appears that palsy of the left side of the body is often consequent on disease or injury of the right side of the brain; but there are some exceptions, as in case No. 20, in which palsy of the right side of the body was the result of blood effused on the same side; and, in cases marked 22, 23, 24, 25, and 76, though there was extensive disease of the right hemisphere of the brain, accompanied in some cases by fracture of a corresponding portion of the skull, *there was no degree of palsy* of the left side.

From the subjoined cases it follows, that the results obtained by pathological investigations are, with a few exceptions, very different from those of the experiments made upon the brain and the cerebellum of inferior animals.

From the above, it seems to me that we are still much in the dark as to the functions of the different parts of the brain, and also that there is much ambiguity as to the characteristic symptoms of the various diseases to which the brain and its membranes are liable.

Three Engravings are attached, to render the description more intelligible.

A

DESCRIPTION

OF THE

HUMAN BRAIN.

ON THE BRAIN AND ITS INVESTING MEMBRANES.

The Brain is the common centre of the Nervous System, to which the impressions of external bodies on the nerves are communicated, and from which those actions originate which are performed by the organs immediately under the dominion of the will.

The brain is the seat of the intelligent, thinking, and reasoning principle; in proof of which, though the spinal cord and nerves be divided or diseased, the mental powers continue unimpared. This is obvious in diseases of the spinal cord: those parts of the body which receive nerves below the seat of the disease become paralytic; but there is a loss of sensation and voluntary motion when the brain has been compressed.

The brain is that mass of matter which, in man, fills the skull; and which corresponds in form with its inner surface.

The brain is well protected from external injury by the skull, the several bones of which are so disposed as to form a solid case, which admits of the growth of the brain, and prevents the effects of the pressure of the atmospherical air.

Owing to the peculiar form of the skull, and the diploe between its component tables, the brain is not liable to suffer from external violence: thus, the effect of a blow is, to a certain degree, averted, a shock being less readily communicated through the spongy diploe, than through more solid bone.

'The brain is somewhat of an oval form: it is broader behind than before; the sides are slightly compressed, and at the under part there are many projections and fissures, which correspond with the inequalities at the base of the skull.

To the touch the brain is somewhat elastic.

The brain of different individuals, and of different animals, and at different ages, varies a little in colour. I have examined it in a criminal about three hours after death, and found it to be of a greyish-brown tint in the adult. The colour, however, depends on the quantity of blood which is sent to it; hence it is redder in early than in advanced life, and becomes still more so in consequence of inflammation. In old age it becomes of a greyish colour, and also in persons who have died from dropsy, or chronic disorders.

OBSERVATIONS ON THE WEIGHT OF BRAIN, AND PROPORTIONS OF ITS PARTS.

ARISTOTLE and PLINY have described the human brain as larger than that of any animal. This holds true, excepting with respect to the elephant and larger cetacea. But when we compare the bulk of the brain in respect to the body, many exceptions to the above observation present themselves.

According to BUFFON, that of the seal bears a greater proportion to the rest of the body; and, according to CUVIER,

the same holds true in respect to the mole and to many birds: further, the brain of the elephant, and of horned animals remarkable for their sagacity, is, in proportion to the bulk of their bodies, below the average standard.

I subscribe entirely to the sentiments of Mr Lawrence on this point. He says,

"It must be acknowledged, that the inquiries into the relative weight of the brain and the body, and the comparison between the former and the nerves connected with it, have not yet afforded any precise and clear information respecting the difference between man and animals, nor on the grounds of the infinitely various faculties that distinguish different animals. It can hardly be expected that these matters will receive any clear elucidation while we continue so ignorant, as at present, of the functions executed by the different parts of the encephalon."

The brain fills the skull, the inner table of which is an exact impress of the form of the surface of the dura mater; hence, by filling the skull with sand, and plugging up the foramina of the skull, upon making a slight deduction for the thickness of membranes of the brain, after having previously ascertained the proportional weight of the dry sand to the substance of the brain, a pretty accurate idea may be had of the capacity and weight of the brain.

Severinus, Diemerbrock, Riolan, Haller, Meckel, Autenrieth, Soemmering, Daubenton, the brothers Wenzel, and other distinguished anatomists, have published the results of their observations as to the weight of the brain, of its different parts, and of the proportional weight of one part of the brain to another, and of the brain to the cerebellum. But as different weights were employed, as the different parts of the brain were cut asunder in different ways, and as

their inductions were incorrect, more especially those of Severinus, Riolan, Diemerbrock, and Autenrieth, as to the comparative size of the male and female, and those of Gall as to the proportional size of the sound brain and cerebellum, and as to the latter not being proportionally less than the former in castrated animals, and as the inductions were in some instances drawn from few specimens, and few observations, I thought it of much moment to weigh the brain as a whole, and also after having divided, at a certain place, the brain from the cerebellum.

Circumstances induced my much esteemed friend and colleague Sir William Hamilton to undertake this investigation, and he has prosecuted it with indefatigable zeal and success. He has favoured me with the general results of his observations on this subject, which I subjoin in his own words. I hope he may soon publish the details of his experiments.

"The following, among other conclusions, are founded on an induction drawn from above *sixty human brains*—from nearly *three hundred human skulls*, of determined sex, the capacity of which, by a method I devised, was taken in sand, and the original weight of the brain thus recovered—and from more than *seven hundred brains of different animals*.

1. The adult male Encephalos is heavier than the female; the former nearly averaging, in the Scots head, 3 lb. 8 oz. troy, the latter 3 lb. 4 oz., the difference 4 oz. In the male, about 1 brain in 7 is found above 4 lb. troy; in the female, hardly 1 in 100.

2. In Man, the Encephalos reaches its full size about seven years of age. This was never before proved. It is commonly believed that the brain and the body attain their full development together. The Wenzels rashly generalized from *two* cases the conclusion, that the brain reaches its full size about

seven years; as SŒMMERING had, in like manner, on a *single* case, erroneously assumed, that it attains its last growth by three. GALL and SPURZHEIM, on the other hand, assert that the increase of the encephalos is only terminated about forty. This result of my induction is deduced from an average of thirty-six brains and skulls of children, compared with an average of several hundred brains and skulls of adults. It is perhaps superfluous to observe, that it is the greater development of the bones, muscles, and hair, which renders the adult *head* considerably larger than that of the child of seven.

3. It is extremely doubtful whether the cranial contents usually diminish in old age. The vulgar opinion that they do, rests on no adequate evidence, and my induction would rather prove the negative.

4. The common doctrine, that the African brain and in particular that of the Negro, is greatly smaller than the European, is false. By a comparison of the capacity of two Caffre skulls, male and female, and of thirteen Negro crania, (six male, five female, and two of doubtful sex), the encephalos of the African was found not inferior to the average size of the European.

5. In Man, the Cerebellum, in relation to the Brain proper, comes to its full proportion about three years. This antiphrenological fact is proved by a great induction.

6. It is extremely doubtful, whether the Cerebellum usually diminishes in old age; probably only in cases of *atrophia senilis*.

7. The Cerebellum, in the female, is in general considerably larger, in proportion to the Brain proper, than in the male. In the human subject, (the tuber excluded), the former is nearly as 1 to 7.6; the latter nearly as 1 to 8.4: and this sexual difference appears to be more determinate in man than

in most other animals. Almost the whole difference of weight between the male and female encephali lies in the brain proper; the cerebella of the two sexes, absolutely, are nearly equal,—the preponderance rather in favour of the women. This observation is new; and the truth of the phrenological hypothesis implies the reverse. It confirms the theory of the function of the cerebellum noticed in the following paragraph.

8. The proportion of the Cerebellum to the Brain proper at birth, varies greatly in different animals. Physiologists have hitherto believed, that the cerebella of all animals, indifferently, were, for a certain period subsequent to birth, greatly less, in proportion to the brain proper, than in adults; and have taken no note of the differences in this respect between different classes. Thus completely wrong in regard to the fact, they have wholly overlooked the law by which it is governed. In those animals that have from the first the full power of voluntary motion, and which depend immediately on their own exertions and on their own power of assimilation, for nutriment, the proportion of the cerebellum is as large, nay larger, than in the adult. In the chicken of the common fowl, pheasant, partridge, &c., this is the case; and most remarkably after the first week or ten days, when the yolk (corresponding, in a certain sort, to the milk in quadrupeds), has been absorbed. In the calf, kid, lamb, and probably in the colt, the proportion of the cerebellum at birth is very little less than in the adult. In those birds that do not possess at once the full power of voluntary motion, but which are in a rapid state of growth, the cerebellum, within a few days, at least, after being hatched, and by the time the yolk is absorbed, is as large or larger than in the adult; the pigeon, sparrow, &c. &c. are examples. In the young of those quadrupeds that for some time wholly depend for support on the

milk of the mother, as on half assimilated food, and which have at first feeble powers of regulated motion, the proportion of the cerebellum to the brain proper is at birth very small; but, by the end of the full period of lactation, it has with them, as with other animals, (nor is man properly an exception), reached the full proportion of the adult. This, for example, is seen in the young rabbit, kitten, whelp, &c.: in them the cerebellum is to the brain proper at birth about as 1 to 14; at six and eight weeks old, about as 1 to 6. Pigs, &c., as possessing immediately the power of regulated motion, but wholly dependent on the milk of the mother during at least the first month after birth, exhibit a medium between the two classes. At birth, the proportion is in them (as I recollect) about 1 to 9, in the adult as 1 to 6. This analogy, at which I now only hint, has never been suspected; it points at the new and important conclusion (corroborated by many other facts), that the cerebellum is the intracranial organ of the nutritive faculty, that term being taken in its broadest signification, and confirms also an old opinion, recently revived, that it is the condition of voluntary or systematic motion.

9. Castration has no effect in diminishing the cerebellum, either absolutely, or in relation to the brain proper. The opposite doctrine is an idle fancy; though asserted by the phrenologists as their most incontrovertible fact. Proved by a large induction.

10. The universal opinion is false, that man, of all, or almost all animals, has the smallest cerebellum in proportion to the brain proper. *Many* of the commonest quadrupeds and birds have a cerebellum, in this relation, proportionally smaller than man.

11. What has not been observed, the proportion of the Tu-

ber Annulare to the Cerebellum, (and *a majore* to the Brain proper), is greatly less in children than in adults. In a girl of one year, (in my table of human brains), it is as 1 to 16·1; in another of two, as 1 to 14·8; in a boy of three, as 1 to 15·5; and the average of children under seven, exhibits the Pons, in proportion to the cerebellum, much smaller than in the average of adults, in whom it is only as 1 to 8, or 1 to 9.

12. In specific gravity, contrary to the current doctrine, the encephalos and its parts vary very little, if at all, from one age to another. A child of two and a woman of a hundred years are, in this respect, nearly equal, and the intermediate ages shew hardly more than individual differences.

13. The specific gravity of the brain does not vary in madness—if one case of chronic insanity is to be depended on, contrary to what has been alleged. In fever it often does, and remarkably.

14. The cerebellum (the converse of the received opinion), has a greater specific gravity than the brain proper; and this difference is considerably more marked in birds than in man and quadrupeds. The opinion also of the ancients is probably true, that the cerebellum is harder than the brain proper.

15. The human brain does not, as asserted, possess a greater specific gravity than that of other animals."

Of the Consistence of the Brain.

I have examined the state of the brain of four or five criminals about two hours after death, and have invariably found it soft externally as well as internally, and of a paler colour than usual; and there was nothing particular as to its grey or white matter. The brain acquires greater firmness in proportion as the body cools; hence in the bodies of criminals,

dissected soon after death, the brain is of a softer consistence. In two instances there was a small quantity of a reddish fluid within the ventricles of the brain; and in one instance, there was about half an ounce of a colourless fluid at the base of the brain. In three persons there was a slight effusion of a colourless fluid between the membranes.

It varies much in firmness in different individuals, and from a variety of circumstances.

The younger a child, the softer is the brain: in a fœtus it is gelatinous. In cold-blooded animals, it is much softer than in the warm-blooded.

I have examined with much attention the brains of three maniacs, without being able to discover any morbid appearances; and GREDING, HASLAM, PINEL, and others, have proved, that the same morbid appearances are discovered in the brains of maniacs, as in persons who have died from apoplexy, epilepsy or convulsions.

The brain, in consequence of apoplexy, hydrocephalus, and typhus fever, often acquires an unnatural degree of softness, and sometimes it is converted into a substance like custard.

On the other hand, the brain of idiots sometimes attains an unnatural and partial degree of hardness and solidity. The hardened portion of the brain looks like an inorganic substance; no vessels can be seen in it.

Of the Tunics of the Brain.

In all red-blooded animals, the brain has three membranes, the *Dura mater*, the *Arachnoid Coat*, and *Pia mater*.

The dura mater is fixed, especially at the sutures, very intimately to the internal table of the skull, by a number of bloodvessels and fibrous threads, and hence when the skull-

cap has been forcibly detached, this membrane is covered by a number of red points, being the orifices of torn bloodvessels, which connected it to the inner surface of the skull: these are most numerous in the vicinity of the venous sinuses.

The dura mater has been called the *Periosteum of the internal table of the Skull.* It tends also to support and defend the brain.

The dura mater, formerly the supposed origin of all the other serous membranes, gives a general covering to the brain and nerves connected with it.

It is strong and inelastic, of a firm and compact texture, of a leaden, or rather purplish colour, and is made up of tendinous-like fibres, which differ much in size, and are disposed, on its outer surface, chiefly in a longitudinal direction; but, on its inner surface, the greater number of the fibres are transverse, and these are crossed by others following different directions.

It is nearly opaque, remarkably tough, and about a line in thickness; its thickest part being at the temporal regions, where the great menengeal arteries are situated, its outer surface is rough and flocculent; its internal surface is very smooth, polished, and of a glistening appearance, being besmeared by a serous fluid, and is in contact with the subjacent arachnoid coat, of which it is a reflection.

The fibrous portion of the dura mater is composed of two laminæ. In a preparation in the Museum, these two laminæ were separated from each other to a small extent, and a quantity of fluid was interposed between the layers, so as to form a tumour about the size of a small olive. This tumour was placed in the immediate vicinity of the super-longitudinal sinus, where it is about to divide into the lateral sinuses. The patient laboured under paraplegia, followed by delirium of

some duration, and coma shortly before death. There was a good deal of water in the lateral ventricles, and in the sheath of the spinal chord.

Though this membrane, in its natural state, possesses but a small share of elasticity, or extensibility, it sometimes admits of considerable extension from disease, as in those cases in which a large quantity of water has collected within the ventricles of the brain, in consequence of the disunion of the bones of the skull. Perhaps, in this instance, there is an addition of matter to the membrane, as of muscular substance to the womb when it is extended during pregnancy.

The dura mater has been occasionally ruptured *, in consequence of distension from water accumulated within the ventricles of the brain.

This membrane also lines the whole of the inner surface of the skull. It insinuates itself into the foramen cæcum; is firmly fixed into the crista-galli of the ethmoid bone; and it forms sheaths for the nerves and bloodvessels which pass through the cribriform plate. It lines also the foramina of the skull through which the nerves pass, and covers the optic nerve, as far as the sclerotic coat of the eye, and is continuous with the periosteum of the orbits.

The dura mater extends backwards horizontally over the grooves on the upper angles of the partes petrosæ, and encloses the superior petrosal sinuses. It lines the meatus auditorius internus, it includes the lateral and occipital sinuses, and commonly divides the foramen lacerum into two parts, though, in some cases, the division is bony.

The dura mater is also continued backwards to the cuneiform process of the os occipitis, from which it passes down-

* Vide Med. Chir. Trans. of London, vol. viii. p. 51.

wards into the spinal canal, to form a sheath for the spinal marrow.

An elongation of the dura mater extends vertically from the front to the back part of the head in the middle line of the skull, and divides, to a certain extent, the hemispheres of the brain.

This portion of the dura mater is but narrow in the fore-part of the head, where it is fixed to the ethmoid and frontal bones; but as it sweeps backwards over the corpus callosum, it becomes gradually deeper, so as somewhat in form to resemble a sickle; and hence it has been called *Falx Cerebri* *.

The upper convex and thicker border, between the layers of which the superior longitudinal sinus is placed, is fixed to, and connected with, the middle of the frontal, parietal, and the middle perpendicular ridge of the occipital bones, and at length is attached to the middle of the horizontal partition interposed between the posterior part of the cerebrum and cerebellum, called *Tentorium Cerebello-superextensum*. The inferior concave edge is not connected with any part, and corresponds in form to the superior surface of the corpus callosum, over which it is applied.

There are sometimes apertures of considerable size in the falx cerebri. I met with one instance, in which there was an aperture of an oval shape, about two inches long, through which a process of the brain passed. In another instance, the falx was wanting. This sometimes occurs in congenital idiocy.

The length and breadth of the falx of the lower animals are much less than in man. In many birds, in the seal, and in the feline tribe, the tentorium is osseous.

The dura mater is supplied with blood from the external

* Vide Blumenbach's Comp. Anat. by Lawrence.

and internal carotid, and also from the vertebral arteries. But nerves have never yet been traced into its substance.

The upper surface of the dura mater, when the venous sinuses are empty, is depressed into the form of a groove, which extends from the os frontis to the tentorium cerebello-superextensum; and, at the sides of this depression, there are several small bodies, of a reddish colour and granular appearance, which, generally speaking, are about the size of pins' heads, and vary much in size, and number, and situation in different individuals. On some occasions these bodies are large, and are lodged in depressions of the skull; but in others they are so small as almost to escape observation. These have been described by PACCHIONI as being *glandular*, by others as forming *a part of the absorbent system;* but we are completely in the dark as to their functions.

The tentorium cerebello-superextensum, or transverse middle septum, on which the posterior lobes of the brain rest, and which separates these from the cerebellum, is fixed to the grooves and transverse ridges of the os occipitis, to the ridges of the partes petrosæ of the temporal bones, and to the clinoid processes of the sphenoid bone.

Between the transverse septum and posterior clinoid processes, there is an oval-shaped aperture, where the cerebrum and cerebellum are united.

The falx and the tentorium cerebello-superextensum being connected and continuous processes of the dura mater, mutually support each other, and prevent the one hemisphere of the brain from gravitating on the other, or on the cerebellum.

The cerebellum has also its falx, which is fixed to the middle perpendicular ridge of the occipital bone, and terminates at the edge of the foramen magnum ossis occipitis.

The SUPERIOR LONGITUDINAL SINUS, placed between the

layers of the dura mater, takes its rise at the crista-galli of the ethmoid bone, runs along the upper part of the falciform process of the dura mater, becoming gradually larger as it approaches the back part of the head, and divides, opposite to the most prominent part of the os occipitis, into two lateral branches or sinuses. The venous sinuses of the brain are large veins inclosed between the layers of the dura mater.

The smaller veins of the superior surface of the brain open into the superior longitudinal sinus, chiefly at its upper and back part, with their orifices almost always directed obliquely forwards.

The right and left branches of the superior longitudinal sinus, called the LATERAL SINUSES, which are lodged in the grooves of the occipital, parietal, and temporal bones, follow a tortuous course, and at length terminate in the internal jugular vein.

The FOURTH SINUS is a short venous canal, situated at the junction of the falx and tentorium; it is formed by the union of the inferior longitudinal sinus, and the vena magna GALENI; it passes downwards and backwards, and joins the lateral sinuses.

The INFERIOR LONGITUDINAL SINUS, lodged in the under part of the falx, is very small when compared with the upper, and is sometimes wanting.

There are also various sinuses, situated at the base of the skull, which have been named from their situation or form. These are the SUPERIOR and INFERIOR PETROSAL SINUSES; the former is situated upon the ridges of the partes petrosæ, and the latter at the sutures which join the lower edges of the partes petrosæ of the temporal to the basilar processes of the occipital bones.

The CIRCULAR SINUS of RIDLEY surrounds the pituitary

gland: it is of a small size, and receives the veins of the dura mater which are in its vicinity.

The CAVERNOUS SINUSES, consisting of a plexus of small veins, begin at the anterior clinoid processes, extend backwards, in a horizontal direction, at the sides of the sella turcica, and terminate in the superior and inferior petrosal sinuses.

The torcular HEROPHILI is a small cavity formed at the points of union of the superior longitudinal, sinus quartus, two occipital and transverse sinuses.

Within these cavernous sinuses the *internal carotid arteries* are placed.

The transverse sinus unites the petrosal and cavernous sinuses of the opposite sides.

The arteries of the anterior part of the dura mater are derived from the ocular artery; those on the middle part from a branch of the external carotid; those of the posterior part from the vertebral arteries. The veins which correspond with these arteries enter the sinuses at the base of the brain; and, owing to the tough and inelastic nature of the dura mater, and to the sinuses being lodged in grooves of the skull, or being connected with the falx or tentorium cerebello-superextensum, these sinuses can neither be extended, so as to compress the brain, nor ruptured; and, on the other hand, their opposite sides cannot be compressed, by the weight of the brain, to such a degree as to interrupt the flow of blood through them.

Of the Arachnoid Coat.

This very thin coat lines the dura mater. It is spread over the convolutions of the brain, but does not penetrate between

them : it does not adhere to the pia mater intimately, and may be detached readily from it, by inflation, especially at the base of the brain, where it is naturally unconnected to the other membranes.

In very early life, this coat is so thin as to be pellucid ; and it adheres so intimately to the pia mater, that it can scarcely be separated from it ; but in very advanced life it becomes thicker and semiopaque.

On account of the extreme thinness of this membrane, it is difficult to detect its structure. I am inclined to suppose it a serous membrane ; for, like other serous membranes, it forms a bag, without an external opening, and gives a lining to the vessels and nerves ; has a smooth surface, which is lubricated by a serous fluid ; is subject to the same organic derangements as membranes of that description, and is sometimes thickened, and partially ossified.

There are no vessels proper to this coat which are of such a size as to admit the red blood. It is yet doubtful whether absorbent vessels exists in this coat or not.

Of the Pia Mater.

The third membrane of the brain, called *Pia Mater*, consisting almost exclusively of arteries and veins, varies much as to its thickness and toughness in different situations ; in some places being as thin as a cobweb.

This membrane not only covers all the outer surfaces of the brain and its projections, but also enters in between its convolutions, forming processes of a spongy consistence, called *Tomenta Cerebri* ; and these tomenta are fixed to the brain by bloodvessels, and fine cellular substance.

The brain receives its blood by the medium of this membrane, which is spread out on its surface.

The tomenta cerebri do not come into contact with the white part of the brain. The outer surface of this membrane is smooth, but the inner seems villous, which is owing to the great number of small bloodvessels torn in raising it from the brain.

Between the middle lobes, at the base of the brain, the arachnoid coat is detached from the pia mater, for the space of a quarter of an inch, between the crura cerebri and tuber annulare.

The most remarkable process or prolongation of the pia mater, is that which is situated under the fornix.

There is a transverse slit in the back part of the corpus callosum, at which the pia mater enters, to be united with the *velum*, or *tela choroidea.*

The tela choroidea is a plexus of vessels, adhering firmly to the lower part of the fornix, which it imprints; it is somewhat triangular, being broader behind, and becoming gradually narrower before.

The pia mater covers and adheres to the thalami nervorum opticorum, and corpus fimbriatum; it also covers the corpora quadrigemina, and involves the pineal gland.

The velum separates, under the anterior crura of the fornix, into two small portions, between which there is a passage to the third ventricle; and these two small portions of the velum are united with the anterior and smaller extremities of the choroid plexuses, below which the lateral ventricles communicate with each other.

In each tela choroidea, there is a large vein, which is directed backwards, and behind the pineal gland. The veins of opposite sides are united, and form a large vein, called Vena

Magna Galeni, which discharges its contents into the sinus quartus.

The pia mater receives a large supply of blood from the internal carotid and vertebral arteries.

The larger branches of the veins of the pia mater are situated between the convolutions of the brain: the greater number ascend, and terminate in the superior longitudinal sinus.

The brain fills the cranium, which is impressed by the surface of the dura mater.

The upper part of the brain is divided into two great parts or hemispheres; the smaller extremities of which are directed forwards; and their length is to their breadth as 4 to 3.

The surfaces of the hemispheres, called co-mutual, which are opposed to the falciform process of the dura mater that separates them, are nearly flat, though not destitute of convolutions.

All the parts of the brain are double. It has been commonly described as being symmetrical, so that, if divided into two halves, by a line drawn vertically from the fore to the back part, its opposite sides would be equal; whereas, if the brain be examined with great care, it will be found that, except a general correspondence in form and appearance, the opposite halves are neither exactly similar as to size nor as to shape, an observation which applies not only to the surface, but also to the internal parts of the brain. Thus we sometimes observe the hemispheres of unequal size, and the convolutions of one side of the brain much more prominent than those of the opposite side. There is also sometimes a most marked difference as to the size of the thalami, or colliculi nervorum opticorum, and of the corpora striata of the lateral ventricles.

The brain is divided to a certain extent only into two hemispheres, by a fissure; and, on examining the bottom of

the fissure, after gently separating the hemispheres, a white body, about half the length of the hemispheres, comes into view, which unites them, and is lost in their substance, and which has been called *the greatest commissure*, or *corpus callosum*.

Each hemisphere is slightly and uniformly arched above, irregular beneath, and subdivided into three lobes. The anterior lobes rest upon the orbitar processes of the frontal bone. The middle, which are separated from the anterior by the fossa Sylvii, occupy the cavity formed by the sphenoid and temporal bones; and the posterior lobes rest upon the tentorium cerebello super-extensum.

The brain of the ape is divided, like the human brain, into two great hemispheres, which are nearly similar in form.

The brain may be described as consisting of a central part, and of folded laminæ or convolutions, but which are not exactly uniform as to breadth, shape, size, or number.

These convolutions are externally of a greyish-brown, but internally of a white, colour, and are disposed nearly at right angles to the surface of the central part.

When a considerable quantity of water has been collected within the ventricles, the surface of the brain is uniform; it looks like a bag of water, and, on cutting through this bag, the parietes are found to be composed of the grey and white substance of the brain, *disposed in a parallel direction in respect to each other;* a proof of the unfolding of the convolutions.

The brain is composed of two substances, very different in colour, consistence, extent, and sensibility, the boundaries of which are not well defined.

The outer, or grey part, as it is commonly called, is somewhat of a light-brown or purple colour in the very recent

brain, semitransparent, gelatinous, soft, and very vascular; it is softer than the white part; and, when dried, it assumes somewhat of a horny appearance. When examined by the microscope, it is found to consist chiefly of bloodvessels.

Albinus, and also Sœmmering, have proved, that, besides the bloodvessels, there is another substance in the cortical part, which is probably secreted by the bloodvessels; but whether we are to join Malpighi in considering it to be glandular is to me very doubtful.

The white part of the brain in the fœtus, is formed before the grey part.

Within the grey substance there is an opaque, more firm, and white substance, which, when dried, shrinks considerably, and assumes a yellow horny appearance.

In cases of long continued jaundice, occasioned by a diseased liver or spleen, the skull and dura mater acquire a yellow or greenish hue, and also the cineritious or medullary part of the brain.

The position of the grey, in respect to the white part of the brain, varies in different parts: in the hemispheres it is external, but in other parts of the brain, and in the spinal cord, internal. The white part constitutes the greater share of the hemispheres of the brain, and also a portion of the medulla oblongata, and medulla spinalis, and is most abundant in the human brain.

Different opinions have been entertained concerning the nature of the white matter. By some anatomists it has been stated, that it consists of a number of small tubes, disposed in a parallel manner in respect to each other; and by Vieussens*, Malpighi, my Father, Cuvier, and others, it has been represented as fibrous.

* Lib. i. cap. 10.

In the section of the recent brain, published by my Father, the fibres are represented as following different directions, which corresponds exactly with CUVIER's description of them, who, speaking of the white substance, has observed, "elle paroit à l'oil composée de fibres très fines, dont les directions varient*."

The fibres of the white part of the brain are seen with the naked eye, by scraping the recent brain in the direction of the fibres, or by putting the brain for eight or ten minutes into boiling oil, or by immersing it in alcohol, or the nitric and muriatic acids diluted with alcohol; and, in some cases of the chronic form of dropsy of the brain, I have seen the fibres of it very distinctly.

These fibres, according to SPURZHEIM, may be traced from the corpora pyramidalia to the tuber annulare; from thence to the crura cerebri, corpora striata, and substance of the brain; but they do not, in my opinion, follow, when viewed by the naked eye, so regular a course as has been described and represented by Drs GALL, SPURZHEIM, and REIL †.

In the substance of the white part of the brain, a number of red points, or the orifices of cut vessels, may be perceived; and, upon examining with attention the white matter, a number of fibres, disposed in different directions, may be observed by the aid of magnifying glasses.

The white part of the brain, when pressed between the fingers, has a soapy feel.

The substance of the white part of the brain which enters into the convolutions, may be unfolded by pouring water on it, drop by drop: it appears, by the microscope, to be com-

* Tom. ii. p. 100. Paris 1800.

† Vide REIL's Observations, translated by Mr MAYO.

posed of a number of very small globules, and of fibres, united by a viscid mucus.

These globules form the fibres.

Prochaska observes, that both the cineritious and white parts are composed of innumerable round globules, united by a transparent cellular membrane, disposed in right lines, and which round bodies are about eight times less than the red globules.

The size of the globules is not uniform in different brains; and they differ as to size in the different parts of the same brain. Mr Bauer perceived, by the aid of the microscope, globules in the recent human brain, which had been steeped in distilled water, proceeding in straight lines from the cortical into the white part; so that the brain has a fibrous appearance. The size of the globules, he observes, varies from $\frac{1}{2400}$ to $\frac{1}{4000}$ of an inch; and they vary in size in different parts of the brain*. The different appearance in the different parts of the brain depends on the size of the globules, and the proportions they bear to the other parts.

The globules are seen very distinctly arranged in rows; and, when the brain is magnified 25 times, the globules are seen arranged in straight lines, which pass uninterruptedly across the cortical substance into the medullary.

A horizontal section of the hemispheres of the brain, made a little above the level of the corpus callosum, exposes the greatest proportion of the white to the grey substance,—the former of which assumes an oval shape, and has been called the *Centrum ovale medullare* of Vieussens.

On cutting down on each side of the corpus callosum, we get into two oblong cavities, placed horizontally, and which

* Phil. Trans. for 1818 and 1821, p. 27.

Baron HALLER has well named, on account of their figure, *Ventriculi Tricornes*, each of them having three cornua. But it is improper to call these cavities, as, in a sound brain, their opposite surfaces are in contact. The lateral ventricles are proportionally much larger in the fœtus than in the adult. This observation applies especially to these cornua.

REIL has described the case of an idiot, in whom he found the middle part of the corpus callosum wanting; the convolutions of the brain were complete where the corpus callosum should have been joined to the inner surface of the hemispheres.

The middle portions of the lateral ventricles are nearly parallel to the corpus callosum. The anterior cornu inclines rather outwards, but not so in all cases. The middle cornu is directed downwards, and is there reflected obliquely from behind forwards and inwards. The posterior cornu passes backwards into the posterior lobe, and ends in a blind sac, which is reflected inwards.

The sides of the ventricles are constantly bedewed by a fluid, which is secreted by the vessels distributed upon the membrane which lines them.

The anterior and posterior cornua of the lateral ventricles are placed nearly horizontally.

There is often a difference as to the size of the posterior cornua in the right and left ventricles of the same subject, and a still greater difference in different persons: it sometimes extends very near to the extremity of the posterior lobe, ending in a *cul de sac*, the point of which is reflected inwards. The ventricles differ much in form in the class Mammalia. The WENZELS have remarked, "Equidem superior eorum pars ad magnitudinem totius cerebri fere eandem habere proportionem videtur, quam superior lateralium ventri-

culorum pars in homine ad magnitudinem totius ejusdem cerebri habet, sed pars eorum posterior ac inferior ab ea, quæ in homine constans est, structura admodum differt. Primo enim posteriora cornua plane desiderantur*."

The corpus callosum is situated in the mesial plane of the brain, and extends from before backwards. It is of a brilliant white colour, of an arched form, being somewhat convex superiorly, about an inch broad, and from three to four inches long, posteriorly than anteriorly broader. On its superior surface, and running from before backwards, are two small elevated lines, with many faint transverse ones diverging from them externally.

The groove between these, called *The Raphè*, lodges the arteria callosa cerebri. The posterior margin of the corpus callosum is somewhat concave, and is in contact with the superior vermiform process of the cerebellum; its posterior and under surface rests upon the nates of the corpora quadrigemina. Posteriorly and laterally the corpus callosum is continuous with, or runs into, the posterior crura of the fornix; laterally it is continuous in its whole extent with the medullary substance of the hemispheres. Anteriorly it turns downwards and backwards, winding round the anterior commissure, and is in contact laterally with the corpus striatum. The corpus callosum may thus be viewed as a large commissure between the two hemispheres of the brain. Inferiorly and posteriorly the corpus callosum is continuous with the fornix; but, about its middle, and anteriorly, its under surface is connected with the septum lucidum.

This septum consists of four laminæ, the two external of which are grey or cineritious, the two internal medullary.

* Vide Wenzel, De Penitiore Fabrica Cerebri, p. 196.

It is placed vertically between the corpus callosum and the fornix, and runs from before backwards, connecting these two bodies. Its superior edge is somewhat convex, and is attached in its whole length to the under or concave surface of the corpus callosum; its under is concave, and is attached posteriorly to the body of the fornix, and anteriorly to that portion of the corpus callosum which winds downwards and backwards around the anterior commissure of the brain.

The plates of medullary substance which form the septum lucidum may, by inflation, be separated from each other; and sometimes a watery fluid insinuates itself between them. The small space intervening between the medullary plates is called *a fifth ventricle.*

The fornix is the continuation of the corpus callosum and septum lucidum; and has been so named from its resemblance to a vault. It has four crura or pillars, two short anterior, and two longer and posterior, which are placed at a distance from each other; are curved; and, descending into the middle or inferior cornua of the lateral ventricles, form distinct processes, which have thin puckered edges, and have been called *The Corpora Fimbriata*, or by Vicq d'Azyr, *Tœnia Hippocampi*, as they are united to the greater hippocampus.

The under part of the fornix is joined to the thalami nervorum opticorum, by a vascular membrane called *Tela Choroidea*, which cuts off the communication between the lateral ventricles, excepting at an oval aperture situated under the anterior crura of the fornix.

The body of the fornix, placed nearly in the centre of the brain, runs from before backwards, immediately under the septum lucidum, in the median plane of the organ. Superiorly it is convex, and continuous in its whole length with the

septum lucidum. Inferiorly it is concave, and lies upon the velum interpositum of HALLER. On its inferior and posterior surface there are a number of obliquely transverse lines, which, from their resemblance to the strings of a harp, are called *The Lyra.* Anteriorly and nearly opposite to the fore and inner part of thalami nervorum opticorum, the body of the fornix divides into its anterior crura. These have the appearance of two small rounded cords, pass downwards and backwards almost contiguous with each other, and terminate inferiorly in the two white bodies seen on the base of the brain,—the corpora albicantia, or candicantia. Anteriorly these crura are in contact with the anterior commissure of the brain. Posteriorly the body of the fornix also divides into two crura, which divaricate considerably from each other. Superiorly, and at their bifurcation, these crura are in contact with the corpus callosum; from this point backwards their upper and inner surface is in contact with this body. Posteriorly and outwardly, and opposite to the corpora quadrigemina, each crus of the fornix ends in a thin lamina of medullary matter, which covers the hippocampus major and minor, and is continuous with the corpus fimbriatum of the hippocampus major. Inferiorly the fornix rests upon a thin membrane, the velum interpositum of HALLER, which stretches across from the plexus choroides of one lateral ventricle to that of the other. The body of the fornix at its centre is about three or four lines thick, but on each side it becomes thinner as it proceeds outwards, and ends ultimately in a thin lamina. The lamina of each side rests upon the corresponding thalamus nervorum opticorum, and forms part of the floor of the lateral ventricle.

Lateral Ventricles.

The LATERAL VENTRICLES of the brain are two irregularly shaped cavities, such as are termed *potential*, each occupying the central parts of the three lobes of each hemisphere. Each lateral ventricle consists of a body and three cornua. The anterior cornu commences opposite to the anterior crus of the fornix, and runs forwards and rather inwards, in the substance of the anterior lobe of each hemisphere, terminating in a broad cavity, at the fore part of the corpus striatum. The inferior cornu commences opposite to the posterior crus of the fornix, runs downwards and forwards for a considerable way, and terminates in the middle lobe near its fore and under part. The posterior cornu commences immediately behind the last, runs backwards into the posterior lobe of the brain, and ends in a rounded extremity. Within each lateral ventricle there are several bodies which require to be described.

The CORPUS STRIATUM commences at the fore-part of the anterior cornu, occupying the whole of the floor of this cavity, and runs outwards and backwards to the posterior part of the body of the ventricle, or to where the inferior cornu commences. The fore and inner part is bounded by the crura of the fornix and corpus callosum, externally by the substance of the brain, internally and posteriorly it is separated from the optic thalamus by the tænia semicircularis. This body commences at the anterior commissure of the brain, runs outwards and backwards immediately behind the corpus striatum, and terminates where the inferior cornu of the lateral ventricle commences. It consists of a band of white or medul-

lary matter, about two lines in breadth, and separates in its whole length the corpus striatum from the optic thalamus.

The OPTIC THALAMUS. Anteriorly it commences opposite to the anterior crura of the fornix, and runs backwards and outwards. Anteriorly and internally the thalami are in contact with the anterior crura of the fornix. Behind the commissura mollis they are in contact with the nates, and still farther back with the corpus geniculatum internum. This last body separates them from the testes. Along their inner side the peduncles of the pineal gland run. Externally the optic thalami are in contact with the tænia semicircularis. Externally and posteriorly the optic thalamus is connected to the corpus geniculatum externum. Here it changes its name, and, as it proceeds forwards, is called Tractus Opticus.

The optic thalamus is broadest at its middle; its surface is perforated by a great many holes, through which veins pass to join the choroid plexus.

At the posterior part of the optic thalamus, and after it has turned downwards and forwards, to become continuous with the tractus opticus, there are two small round bodies, called the CORPORA GENICULATA. The corpus geniculatum internum is placed between the thalamus and testes; the corpus geniculatum externum is opposite to this, the thalamus intervening between them.

There is an oval hole situated under the anterior pillars of the fornix, behind the anterior crura of the fornix and commissura anterior cerebri, on the fore part of the joining of the choroid plexus of the two lateral ventricles of the brain, and over the fore part of the third ventricle. Hence, at this place, *the lateral ventricles of the brain communicate with each other, and with the third ventricle.* This aperture has

been very particularly described by my Father, in his work on the Nervous System*.

I presume the reader will be gratified by the subjoined observations, which have not hitherto been published, and which contain an extract of my Father's own description of his discovery of the communication between the lateral ventricles. In the course of these observations, he has made remarks upon the state of that foramen, when water is accumulated within the ventricles of the brain, and upon puncturing these cavities.

" In the year 1753, I opened the head of a child about two years old, who died of hydrocephalus internus. Both sides of the brain were distended by water, but, on cutting into one hemisphere, the other subsided.

" After laying open both lateral ventricles longitudinally, I took hold of the corpus callosum, and raising it gently, and with it the septum lucidum and fornix, I observed *a passage large enough in this subject to admit the finger, under the fore part of the body of the fornix, by which the lateral ventricles communicated with each other*, and with the top of the third ventricle.

" In all my dissections of the bodies of children who had

* Sœmmering, Vicq D'Azyr, and others, refer to my Father's book for a description of the communication between the lateral ventricles of the brain. Moreau, the editor of the octavo edition of Vicq D'Azyr, has observed, " Les ouvertures qui établissent la communication des ventricules latéraux avec le troisième, sont décrites dans l'ouvrage publié par Monro, en 1783. Cet anatomisse célèbre en a donné plusieurs dessins exacts, et il a fait voir combien ces ouvertures sont augmentées par certaines dispositions morbifiques, et principalement par les amas d'eau dans les cavités cérébrales."

The full account of this discovery was published in the first edition of this book.

died of hydrocephalus (and I have now dissected seven), all the water was lodged within the ventricles. From which, and from my observing that the most accurate authors have generally found it so likewise, I am inclined to suspect, that some have thought the water to be on *the outer side of the brain, when in fact it was within it*, partly from supposing it impossible that *the very tender substance of the brain could be so enormously extended;* and partly from their not knowing that the brain, *when extended, becomes very thin* *, perhaps more than most other organs, when distended by a like cause. Thus, in the brain of the girl of eight or nine years of age, above mentioned, the ventricle was opened before the knife entered above the depth of half an inch: so that unless the skull-cap be very cautiously cut through, the water, by a slight cut or puncture, may be let out, and the dissector hence conclude that it was lodged on the outer side of the brain.

" I have found, that the septum lucidum and fornix were torn on letting out the water from the ventricles after death, or as the rigid bones cannot, by bandage or otherwise, be brought to support the collapsed brain equally, this will be in danger of being broken by the changing the posture of the head; nay, though these immediately bad consequences should not happen, the *distracted fibres of the brain* will scarcely recover their tone; and either the degree of inflammation necessary to cause concretion of the sides of the ventricles, the means Nature usually employs to effectuate a cure in dropsical cavities, where the air is admitted, will kill the patient; or, if such inflammation and concretion do not take

* It is obvious from the above, that, in cases of hydrocephalus, the *brain is extended*, an opinion which Drs GALL and SPURZHEIM have also adopted.

place, the water will again be collected, or the operation will at best prove only palliative. And, indeed, though I recommend tapping where the water is collected on the outer side of the brain, as sometimes is the case, since all other methods of cure almost always fail, yet, I confess, I should not even here expect much benefit from the operation *.

The lateral ventricles being fully exposed, the following parts come into view.

In the anterior cornu of each lateral ventricle, there are two very obvious projections, viz. the *Corpus striatum* and *Thalamus* or *Colliculus nervi optici*, and the *Choroid plexus*.

The corpora striata are externally smooth and convex, of a brown colour, and in shape pyriform, broad before, and narrow behind; and, when divided, are found to be composed partly of cineritious and partly of white matter; and hence exhibit, when divided, a striated appearance.

In the descending cornua of the lateral ventricles, besides the long posterior crura of the fornix, there are two rounded bodies, which are joined to the posterior extremity of the fornix: these are small at their origin, become considerably

* The truth of these observations of my Father have been fully confirmed by experience.

Wepfer, Muraltus, Lizars, Le Cat, Home, and others, have punctured the brain; the relief has been but temporary; in some cases it became necessary to puncture the brain again and again, and the patients, with the exception of the case of which Dr Voss has published an account, died.

The father of a patient whom I had attended for a considerable time, was induced to consent to the puncture of the brain of his child, though Dr Hamilton, and several other physicians, were, like myself, hostile to it. The child died in sixteen hours after the operation. I was requested to examine the state of the brain, and found, that not above a half of the water, which had been contained within the enlarged lateral ventricles, had been discharged.

larger as they descend, and at last terminate in a round nodulated extremity, occupying the lower portion of the descending cornu, and called *Pedes Hippocampi.*

The inner edge of the *hippocampus* is serrated, and the serræ are most distinct in quadrupeds.

While the fornix thus gives a covering to the hippocampus major, part of it is continued along the inner margin of this body, in the form of a narrow band, one edge of which is free or unattached. This body, called the CORPUS FIMBRIATUM, leaves the hippocampus major, at about half an inch from its termination, and is lost in the inner and upper part of the walls of the inferior cornu. Immediately behind this there is a communication between the inferior cornu and surface of the brain, and here the pia mater enters, and becomes continuous with the plexus choroides.

The *hippocampus minor* arises in common with the hippocampus major, but soon separates from it, and sweeps backwards, occupying the interior of the floor of the posterior cornu. It terminates about three lines from the posterior extremity of this cavity. This body is also covered by a layer of medullary matter from the fornix.

The posterior cornua of the lateral ventricles terminate on each side in a rounded *cul de sac.*

THE THALAMI NERVORUM OPTICORUM occupy nearly the whole of the floor of the third ventricle, and intervene between the posterior parts of the corpora striata: they are of a white colour, convex and irregular externally, but there is a quantity of cineritious substance in their internal substance.

The inner surfaces of the thalami nervorum opticorum of the corresponding lateral ventricles are flat, and united by a soft transverse plate of medullary substance called the Commissura Mollis.

The posterior parts of the thalami, called Tractus Optici, are of a white colour, and flat; they are directed outwards and downwards in the form of a curve; they cross over the crura cerebri, and at length terminate in the commissura nervorum opticorum.

There are two tubercles, already described, connected with the lower portions of the thalami nervorum opticorum, which have been called by SANTORINI *Corpora geniculata:* these consist chiefly of white matter.

The greater part of the tractus opticus is concealed by the middle lobes of the brain, excepting about an inch of the anterior portion.

Under the commissura mollis, and between the thalami nervorum opticorum, there is a deep fissure, called the *third ventricle;* and a funnel-like cavity, called *infundibulum*, runs downwards and forwards, and is fixed by its narrow extremity to the pituitary gland.

Behind the commissura mollis, and between it and the junction of peduncles of pineal gland, there is another opening, the foramen commune posterius, which leads into the third ventricle. The velum interpositum of HALLER lies over this. Behind this foramen, and resting on the anterior portion of the corpora quadrigemina, is a small round body,—the pineal gland,—about the size of a small garden-pea, but somewhat flattened. Superiorly it is attached to the velum interpositum of HALLER, by means of bloodvessels. Anteriorly and inferiorly, the pineal gland has, on each side, a small peduncle, which passes a little outwards, and then forwards, along the inner margins of the optic thalami. The peduncles are of a whiter colour than the gland itself.

The GLANDULA PINEALIS is of a light red colour, in form like the tongue, with the narrower end directed backwards.

It lies over the corpora quadrigemina, and is involved in the tela choroidea. The pineal gland is fixed to the posterior commissure, by two long processes of white matter, which gradually become smaller, as they advance forwards, to the inner side of the thalami, and anterior crura of the fornix.

In the centre of this gland, there is generally, after puberty, a sandy substance, of a yellow colour, the proportion of which varies in different cases.

The Third Ventricle is situated between the Thalami Nervorum Opticorum, and under the Commissura Mollis.

Anteriorly it is bounded by the crura of the fornix and anterior commissure; anteriorly and inferiorly by a thin web of grey or cineritious matter, which passes between the anterior commissure and optic commissure; and posteriorly by the posterior commissure of the brain and nates. Its floor is very narrow, and corresponds with that portion of the base of the brain, which runs from the tuber annulare to the infundibulum, passing between the third pair of nerves; the crura cerebri, and corpora albicantia. The third Ventricle is deeper anteriorly than posteriorly; and at its fore part it terminates in a small canal, which leads to the Infundibulum. At the posterior parts of the third ventricle, there is an opening which passes directly backwards, under the corpora quadrigemina, to the fourth ventricle. This is the Aqueduct of Sylvius, or *iter a tertio ad quartum ventriculum.*

The Corpora Quadrigemina are four medullary rounded bodies, placed at the posterior part of the optic thalami, and between the Cerebrum and Cerebellum superiorly. The anterior are the larger.

These bodies are continuous anteriorly, with the posterior commissure of the brain, and laterally with the optic thala-

mus, and are connected externally with the corpora geniculata interna, by small white bands; and, behind this, they are continuous with the crura cerebri; posteriorly and outwardly with the processus a cerebello ad testes, and posteriorly with the valve of VIEUSSENS. Superiorly the corpora quadrigemina are covered by the pia mater, which enters the brain here immediately under the corpus callosum and fornix. Posteriorly and superiorly, they are in contact with the superior vermiform process of the cerebellum.

THE PITUITARY GLAND, or HYPOPHYSIS, is a small oblong-shaped body, which is enclosed by the dura mater, and situated in the sella turcica; it is greyish without, and medullary within; and very different as to consistence in different specimens.

The size of this substance varies in persons of different ages: its bulk is not proportioned to that of the other prominences of the brain, and bears to these a different proportion in different individuals.

The greater diameter of this substance is the transverse, or from side to side; the less from before backwards. The upper surface in early life is convex, in middle life it is nearly level, but in old age concave.

This substance is of a brownish red colour in the fœtus, but in consequence of age it becomes much paler, and the appearance of the cineritious substance is scarcely observable.

In the ox and horse, the glandula pituitaria is proportionally much larger than in man.

Two transverse medullary cords bound the fore and back part of the third ventricle; the one passes immediately before the short anterior crura of the fornix, and unites the corpora striata: this has been called *Anterior Commissure;* and, at the posterior part of the third ventricle, under the root of

the pineal gland, there is a similar, though rather shorter cord, called the *Posterior Commissure.*

Of the Prominences in the Under Surface of the Brain and Cerebellum.

Each hemisphere has by anatomists been divided into three lobes: these are conspicuous, upon examining the base of the brain.

The lobes of the hemispheres are unequal as to size; the anterior, which is the largest, consisting of about one-half of the whole hemisphere.

The under surfaces of the anterior lobes are somewhat excavated, bearing the impressions of the orbitar processes of the frontal bone; and on each side of the longitudinal line, which separates the hemispheres, there is a projecting convolution.

The anterior and middle lobes of the brain are separated by a deep fossa, named *Fossa Sylvii.*

The middle or the most prominent lobes are lodged in the temporal fossæ, and the boundary between these and the posterior lobes is not well defined.

The olfactory nerves, which are flattened, may be observed passing forwards, within distinct grooves of the brain, and terminating in an oval-shaped prominence, which lies on the cribriform plate of the ethmoid bone.

There is a cavity between the middle lobes of the brain, in the fore-part of which there are two white rounded cords, the optic nerves, which are united by a transverse portion.

About one-eighth of an inch behind the union of the optic

nerves, a small reddish funnel-shaped substance is seen, which is connected, by its smaller end, to the *glandula pituitaria.*

There are two white bodies, called *Corpora albicantia*, each of about the size of a garden-pea, which are situated about a quarter of an inch behind the infundibulum. On each side of the corpora albicantia, there is a rounded prominence, the crura cerebri, streaked by a number of furrows, which pass obliquely downwards and inwards, the fore-part of which is concealed by the middle lobe of the brain, and the posterior portion ends in a substance laid transversely across the brain, called *Tuber annulare.*

A brown or black dark coloured substance, is found in the centre of the crura, which has been called *Locus niger crurum cerebri.*

Of the Cerebellum.

The cerebellum occupies the inferior concavities of the occipital bone; it is placed below the posterior lobes of the brain, and lies somewhat like a bridge over the superior surface of the medulla oblongata, but is not in contact with it; for the fourth ventricle intervenes.

The cerebellum presents a laminated surface. The laminæ are between a line and a line and a half in thickness, and are disposed in a concentric and regular manner, in respect to each other; they are long and prominent behind, and shorter before; and there are grooves between them, into which the pia mater insinuates itself.

The number of laminæ is between 90 and 100, in most cases.

The cerebellum in the ape tribe has a greater resemblance to that of man than the cerebella of other inferior animals.

On the anterior and middle part of the upper surface of the cerebellum, there is a process or elongation of the cerebellum, called its *Vermiform process.*

The cerebellum is covered by the same membranes as the brain.

The cerebellum is joined to the cerebrum by two medullary cords, which are inserted into the substance of the cerebellum, and their fibres are intermixed with those of the medulla oblongata.

Inferiorly the cerebellum is convex; consists of two lobes, which are separated from each other by a deep and wide fissure. Its surface is also divided by a great many transverse fissures, which penetrate the lobes to a considerable depth. One of these, which runs obliquely across near the middle part of the lobes, is much deeper than any of the rest. On separating the lobes of the cerebellum from each other, the inferior vermiform process is exposed. It runs from before backwards, in the mesial plane of the cerebellum; is of considerable size, and prominent; and is of irregular shape, being somewhat cruciform.

There are two smaller lobes, one on each side, separated from the great lobes of the cerebellum, and inferior vermiform process, by deep fissures. These bodies have by some, though erroneously, been described as the inferior vermiform processes.

Upon dividing the cerebellum in a plane parallel to the mesian plane of the brain, and distant from it one-third of the breadth of the lobe, the CORPUS DENTICULATUM, or zig-zag body of the crus cerebelli, appears. This body is of an oval shape, denticulated externally, and consists chiefly of grey matter, which is covered by the medullary substance of cerebellum.

By making a vertical section of either lobe of the cerebellum, through its middle, the medullary matter of the crus is seen, branching like a tree, through the cineritious, and forming the *Arbor Vitæ*.

The CRURA CEREBRI and CEREBELLI may be described, either as arising from, or as forming part of, the tuber annulare.

The crura cerebri consist of a great many converging fibres from the different lobes of the brain, which meet and pass under the corpora quadrigemina, into the fore and upper part of the tuber annulare, through the centre of which they pass, and become continuous with the anterior divisions of the medulla oblongata and spinal cord.

The crura cerebelli arise from the central or medullary matter of the cerebellum, and at the side of the tuber annulare split into two bundles of fibres, the one passes forwards and downwards around the crura cerebri, and, at the fore and under part of the tuber annulare, unites with its fellow of the opposite side. On dividing these fibres, which are very distinct, to the depth of about the fourth of an inch, the longitudinal fibres of the crura cerebri are distinctly seen.

The posterior division of the crura cerebelli are united with their fellow of the opposite side, and are continuous with the posterior division of the medulla oblongata and spinal cord.

From the crus cerebelli of each side, and where it is lost in the cerebellum, a lamina of medullary matter passes to the testes, which, from its situation, is called PROCESSUS A CEREBELLO AD TESTES. Between these processes, and continuous with them laterally, we meet with a thin medullary lamina, which passes directly forwards from the medullary matter at the root of the superior vermiform processes to the testes,

which has been named the VALVE OF VIEUSSENS, and forms the roof of the fourth ventricle, which is in shape triangular, with the base placed posteriorly and the apex anteriorly.

The valve of VIEUSSENS is generally covered by a thin layer of grey matter, derived from the superior vermiform process.

By dividing in a longitudinal direction the valve of VIEUSSENS, the cavity of the FOURTH VENTRICLE is exposed. By lifting the cerebellum from the medulla oblongata, and passing a probe forwards between the posterior pyramids, we also get into this cavity.

This fourth ventricle is situated between the crura cerebelli and above the tuber annulare. Its apex, or fore part, commences at the testes; its base, or posterior part, extends to the upper part of medulla oblongata. An opening, anteriorly, leads from it, under the corpora quadrigemina, to the third ventricle.

The proportional size of the brain, in respect to the spinal cord, is different in different animals.

In man the brain bears a larger proportion to the spinal cord than in any other animal, and the spinal marrow very much exceeds in bulk any of the nerves connected with it; but the spinal marrow of the horse and ox is much larger in proportion to the brain; and in fishes, the transverse diameter of the brain scarcely exceeds that of the spinal marrow.

Chemical Analysis of the Brain.

The constituents of the cortical portion of the brain of the calf, are, according to VAUQUELIN, as follows:

Water, ...	75 to 80
Insoluble cerebral albumen, with some soluble do.	10
Osmazome, ...	10 to 15
Fatty matter, ...	
Phosphate of Lime, ...	
Phosphate of Soda, ...	
Phosphate of Ammonia, . . .	
Phosphate of Magnesia, . . .	
A Sulphate, ...	
Common Salt, ...	
Trace of Phosphate of Iron, . .	
	100

The medullary portion of the brain contains the same constituents as the cortical; but the proportion of fatty matter in the latter is greater. Traces of silica are also found in it.

Of the Spinal Cord.

The cranial portion of the spinal cord, usually called the MEDULLA OBLONGATA, connected with the tuber annulare, is about an inch long, and somewhat like a Florence flask, the broader extremity of which, connected with the tuber, is somewhat contracted.

A longitudinal fissure, of considerable depth in front, along its mesian line divides it anteriorly; and posteriorly it is also divided to a considerable depth by a similar fissure. On the fore-part of the medulla oblongata, and immediately on each side of the anterior longitudinal fissure, there are two pyramidal bodies, which are continuous with the fibres of the crura cerebri. These are the ANTERIOR PYRAMIDS, their broadest extremities being placed superiorly. At their upper and inner part, and where they leave the tuber annulare, there is

a blind cavity—the foramen cæcum. On separating the apices of the pyramids from each other, fibres are seen running across between these two bodies. Immediately on the outside of the pyramidal bodies, and on the anterior part of the medulla oblongata, there are two oval-shaped bodies of considerable size, the CORPORA OLIVARIA. These bodies, superiorly, are nearly in contact with the tuber annulare: internally, they are separated from the corpora pyramidalia by a slight groove; externally, they are also separated from the corpora restiformia by a slight groove. On making a vertical section of either olivary body, through its long diameter, a grey body is seen within it; this is called the *Corpus Dentatum* of the olivary body.

The CORPORA RESTIFORMIA occupy the external and posterior part of the medulla oblongata, and are continuous with the posterior portion of the crura cerebelli; anteriorly they are contiguous to the olivary bodies; posteriorly they are separated from each other by two small bodies, the POSTERIOR PYRAMIDS, which occupy the middle portion of the medulla oblongata posteriorly. The posterior pyramids commence at the inferior part of the fourth ventricle, are of small size, and on being traced downwards, soon disappear, and are separated from each other by a narrow, but somewhat deep, groove; and from the restiform bodies by one more superficial.

In illustration of our ignorance of the functions of particular parts of the brain or cerebellum, I have subjoined the following cases:—

Membranes.

1. Three cases in which sharp, irregular, osseous spiculæ were seated on inner surface of dura mater, near superior longitudinal sinus. All cases of *mania*.

2. Osseous spiculæ on surface of pia mater.—*Symptoms.* Delirium, alternating with intervals of sensibility; convulsions; coma.

3. Thin cyst, of the size of a goose's egg, attached to right side of falx cerebri, and occupying the cavity of the right lateral ventricle.—*Symptoms.* Constant headach, especially on right side; pupils dilated; epilepsy.

4. Thickening of pia mater and dura mater.—*Symptoms.* Loss of memory; epileptic fits, terminating in death.

Upper part of Hemispheres.

5. Thickening of arachnoid and pia mater on upper part of right hemisphere; effusion of lymph on arachnoid.—*Symptoms.* Epilepsy.

6. On upper part of right hemisphere, considerable effusion of a thick yellowish fluid mixed with pus. Numerous osseous spiculæ on right side of processus falciformis.—*Symptoms.* Patient sensible; severe general convulsions; headach; paralysis of left side; coma.

7. Great quantity of thick pus beneath dura mater, on upper part of right hemisphere. Subjacent cerebral substance covered by effused lymph.—*Symptoms.* Delirium; pupils dilated; paralysis, with convulsions of left side.

8. Abscess in upper part of right hemisphere; surrounding cerebral substance of a black colour; pia mater thickened and covered by pus.—*Symptoms.* Coma; pain in right ear; urine and fæces passed involuntarily.

9. Serous effusion under arachnoid membrane and in lateral ventricles. Unusual vascularity of substance of brain, dura mater, and dura-matral sheath of spinal cord.—*Symptoms.* Trismus.

10. Four ounces of fluid between dura and pia mater on right side. Exostosis on parietal bone, compressing dura mater. Four ounces of fluid in lateral ventricles. Three ounces at base of skull. —*Symptoms.* Melancholy and imbecility of mind for three years.

11. Effusion of serum between arachnoid and pia mater over the hemispheres, over tubercula quadrigemina, and in the ventricles. —*Symptoms.* Pain in back of head; depression of spirits, and mania.

12. Effusion of serum between arachnoid, and pia mater over the hemispheres, and over the thalami optici.—*Symptoms.* Mania.

13. Pressure by depression of cranium on upper part of hemispheres.—*Symptoms.* Want of sleep; headach; stupor.

14. Tumour compressing upper part of left hemisphere.—*Symptoms.* Melancholy; drowsiness after dinner, always removed by free exposure to the air.

15. Loss of a portion of one hemisphere in consequence of fracture.—*Symptoms.* Difficulty of swallowing; delirium; in 24 hours these disappeared, and no bad symptom followed.

16. Collection of purulent matter on surface of arachnoid.—*Symptoms.* Coma; delirium.

17. Deep wound of right hemisphere of brain.—*Symptoms.* Headach; numbness of left side. Patient recovered, and afterwards performed his duty as a naval officer.

18. Slight serous effusion beneath arachnoid coat. Laceration of upper part of hemisphere. Cerebral substance soft and containing small quantities of pus in several places.—*Symptoms.* Patient perfectly sensible; loss of speech; difficulty of swallowing; delirium; urine and fæces passed involuntarily.

19. Large apoplectic cyst extending throughout the whole length of right hemisphere.—*Symptoms.* Apoplexy, followed by partial paralysis of left side. The patient afterwards recovered and resumed

his duties as a comedian; died of apoplexy two years after the first attack.

20. Meninges inflamed; their vessels turgid. Slight effusion of serum on surface of arachnoid, and in lateral ventricles. Sharp osseous spicula projecting from left parietal bone; subjacent dura mater torn and inflamed.—*Symptoms.* Mania and convulsions of three days duration. *N. B.*—Received no external injury.

Anterior Lobes.

21. Towards back part of left anterior lobe, a tumour of the size of half-a-crown, uncircumscribed, composed of small tubercles, turgid vessels, and softened cerebral substance. Right anterior lobe similarly, but *more extensively*, diseased.—*Symptoms.* Headach; stupor; pupils dilated; vomiting; debility; obstinate constipation; coma.

22. Large abscess in right anterior lobe of brain. Several of the convolutions obliterated.—*No symptoms indicative of affection of the brain.*

23. Tumour of the size of a goose's egg, attached to under part of right anterior lobe of brain.—*Symptoms.* Severe headach; stupor; great pain on moving the head.

24. Large abscess in fore part of right anterior lobe.—*Symptoms.* Headach; no loss of memory; no palsy; no recent febrile symptoms; stupor; coma.

25. Fracture extending from coronal suture to right eyebrow. Fungus cerebri protruding from fracture.—*Symptoms.* Delirium; stupor; coma.

26. A pistol bullet pierced the temporal bone, and lodged immediately in front of the anterior cornu of the lateral ventricle.—*Symptoms.* Stupor for some time after the accident; on recovering from which, *his intellectual faculties were found not at all impaired.*

27. Large abscess between dura mater and os frontis. Pus between dura mater and arachnoid over anterior lobes. Pus and blood in superior longitudinal sinus.—*Symptoms.* Pain in forehead and eye; indistinct vision; patient perfectly sensible; left pupil permanently dilated; general convulsions; coma.

28. Complete ramollissement of a portion of right anterior lobe. Whole of right hemisphere covered by pus. Some purulent matter on surface of medulla oblongata.—*Symptoms.* Subsultus tendinum; pupils dilated; no pain; sensible; strabismus; paralysis, with convulsions of left side; coma.

29. Disease of membranes beneath right side of os frontis. A large cavity in subjacent cerebral substance, containing ℥ij of coagulated blood. Surrounding cerebral matter soft and pulpy. —*Symptoms.* Patient perfectly sensible; vertigo; pain of forehead; frequent startings during sleep; paralysis of *right* side.

30. Extensive depression of the os frontis.—*Symptoms.* Patient lay apparently dead for seventeen hours. Afterwards complained of vertigo, headach, and imperfect paraplegia.

31. Pressure by exostosis, on both anterior lobes.—*Symptoms.* Loss of memory; heaviness, and almost idiocy.

32. Pressure by exostosis and serous effusion on both anterior lobes.—*Symptoms.* Heaviness; loss of memory; fatal apoplexy.

33. Pressure by exostosis on anterior lobes; both anteriorly and laterally.—*Symptoms.* Spasms in lower extremities; total loss of memory.

34. Pressure by large exostosis of os frontis, on anterior lobes. —*Symptoms.* Loss of memory; occasional fits of insensibility; occasional delirium.

35. Pressure from an uniform thickening of so frontis, so as to flatten anterior lobes —*Symptoms.* Powers of mind much impaired.

36. Loss of half an ounce of cerebral substance from anterior lobe, in consequence of fracture.—*Symptoms.* Those common in cases of fracture.

37. Ulceration of anterior lobe, as low as the covering of the lateral ventricle.—*Symptoms.* Paralysis of both arms.

38. A deep wound in the anterior lobe.—*Symptoms.* For several days a *pain in head; no derangement of cerebral functions;* three hours before death became insensible.

39. Fracture of os frontis. Considerable laceration of anterior lobes. Deposition of calcareous looking matter on falx major. —*Symptoms.* Patient subject to epilepsy; loss of sensation and volition.

40. Fracture of orbitar process of os frontis. Dura mater lacerated; extravasation of blood. Laceration of anterior lobes; with marks of incipient suppuration.—*Symptoms.* No pain, and no morbid symptoms for four days after the injury; convulsions and violent pain of head for two days before death.

41. Long transverse fracture in os frontis, through which a fungus cerebri protruded and was removed. After which the patient recovered and conducted an extensive commercial business.

42. Fracture in os frontis. A fungus cerebri protruded; a portion of it was removed, the rest was compressed.—*Symptoms.* Patient merely complained of slight headach, which was much encreased by pressure applied to the tumour.

43. Large coagulum of blood in substance of anterior lobes.— *Symptoms.* A peculiarly dull silent stupid state; *intellect unimpaired.*

44. From ℥iij to ℥iiij of inferior and external part of left anterior lobe, removed by absorption.—*Symptoms. Intellectual faculties unimpaired.*

Anterior and Middle Lobes.

45. Apoplectic cyst in right middle lobe. Ramollissement of right anterior lobe. Serum in ventricles and under arachnoid.

—*Symptoms.* Hemiplegia of left side; pain of forehead; stupor; pupils contracted; two attacks bearing symptoms of apoplexy.

46. Large osseous tumour compressing anterior and middle lobes of left side.—*Symptoms.* Epilepsy.

47. Absorption of cerebral matter above the fissure of Sylvius, and over anterior part of right lateral ventricle.—*Symptoms.* Hemiplegia of left side for seven years.

48. Pressure by exostoses, on lower and lateral portions of anterior and middle lobes of brain.—*Symptoms.* Headachs; general emaciation; irregularity of bowels; difficulty of deglutition; much general irritability.

Middle Lobes.

49. Absorption of a portion of the middle lobe of the brain.—*Symptoms.* Epilepsy.

50. Ramollissement, with suppuration of middle lobe.—*Symptoms.* The patient was subject to deafness from infancy, with purulent discharge from meatus auditorius externus.

51. Tumour of the size of an orange attached to middle lobe of right hemisphere. Surrounding cerebral substance soft and pulpy. —*Symptoms.* Epilepsy.

52. Gelatinous extravasation beneath arachnoid coat on upper part of right hemisphere. Middle lobe of right hemisphere, above pars petrosa of os temporis, inflamed and lacerated. Middle lobe of left hemisphere of a dark colour, soft, and commixed with extravasated blood. Both lobes of cerebellum covered by coagulated blood.—*Symptoms.* Delirium; dilated pupil; convulsions; coma.

53. Large coagulum of blood on upper part of right hemisphere. Substance of brain unusually vascular. Complete ramollissement of anterior and inferior portion of left middle lobe.—*Symptoms.* Insensibility; pupils permanently contracted; paralysis of left side; delirium; coma; pupils dilated.

54. Large abscess in middle lobe. All the nerves at their origins surrounded by pus.—*Symptoms.* Pain and stiffness of back and neck; severe headach.

55 Pressure by exostosis on middle lobe.—*Symptoms.* Pain in stomach; torpor of bowels; nausea; anorexia; pain between shoulders and in the feet.

56. Laceration of left middle lobe. Extravasation of blood into left lateral ventricle, and into substance of brain near lacerated part. —*Symptoms.* Pupil dilated; extreme restlessness; insensibility; alternating with intervals of sensibility.

57. Whole of middle lobe much indurated, and of a dark livid colour.—*Symptoms.* Forty years before death received a blow on right side of head, became afterwards subject to acute headachs; great inclination to sleep, terminating in perpetual coma; *the intellect, naturally superior, remained unimpaired* until the stupor supervened.

58. Same morbid appearance as in the preceding case.—*Symptoms.* Received a slight blow on right side of head, producing a small wound, which remained open for six years. Upon its healing, sight began to fail, and was ultimately entirely lost; epilepsy.

Posterior Lobes.

59. Numerous tumours, varying in size from a pea to a bean, attached to lateral part of posterior lobe of left hemisphere. Surrounding cerebral substance much softened.—*Symptoms.* Severe pain in left side of head. Pains in left shoulder and arm. Deafness in left ear.

60. Effusion of blood over posterior lobes of brain, and of serum in cornua of both lateral ventricles.—*Symptoms.* Vertigo; paralysis; loss of memory. Straight objects appeared crooked to the eye. Idiocy ultimately supervened.

61. Pressure by effusion on lower and lateral part of left posterior lobe.—*Symptoms.* A feeling of uneasiness in the skin of the left cheek, extending downwards on the anterior part of the neck. Tinnitus aurium. Inability to articulate the words he wished, using others in their place; consciousness of doing so, and inability to correct it. Numbness in arms and legs.

62. Tumour imbedded in the substance of the posterior lobe.—*Symptoms.* Derangement of the functions of the stomach and bowels. Double vision, and afterwards complete loss of sight.

Internal and Lower Substance of Brain.

63. All the ventricles much dilated by serum.—*Symptoms.* Headach and vertigo; nausea; subsultus tendinum.

64. Large abscess in substance of right hemisphere, on a level with corpus callosum.—*Symptoms.* Sudden convulsions, terminating in complete hemiplegia of the right side; epilepsy, terminating in fatal apoplexy.

65. Large tumour involving septum lucidum and fornix; adhering to corpus striatum and thalamus opticus.—*Symptoms.* Amaurosis; partial deafness; memory impaired; epilepsy; general rigidity of muscles, excepting those of neck: stupor.

66. Two large tumours, with ℥xii of serum in left lateral ventricle. Substance of middle portion of cerebellum and corresponding nerves almost obliterated.—*Symptoms.* Vertigo; headach; tinnitus aurium; partial amaurosis; vomiting; syncope.

67. Ramollissement affecting the upper surfaces of the corpus callosum, and of the bases of the lateral ventricles.—*Symptoms.* Complete paralysis, with partial loss of sensation, on left side; headach; vertigo; inability to swallow; dimness of sight; coma.

68. Ramollissement of the *whole* brain. Fungus cerebri protruding from a fracture of os frontis.—*Symptoms.* Incessant delirium; coma.

69. Two large cavities in substance of brain, exterior to right lateral ventricle; ℥ss of serum in left lateral ventricle,—right, healthy. —*Symptoms.* Paralysis of left side; vertigo; tinnitus aurium; great debility; syncope; slight convulsions; coma.

70. Two tubercles of the size of pease, attached to tentorium; other two in medullary substance of right hemisphere; and one of the size of an almond imbedded in pons varolii.—*Symptoms.* Paralysis of right side; spastic rigidity of left arm. The head symptoms were of short duration. The patient, a boy, was considered *active* and *clever*.

71. Medulla oblongata and spinal cord sound. Tumour of the size of a chestnut attached to arachnoid, and imbedded in substance of posterior lobe of left hemisphere. Other two tubercles in each hemisphere, imbedded in the medullary walls of the lateral ventricles. Left hemisphere of cerebellum, much softened, contained a tubercle of the size of a large almond.—*Symptoms.* The patient had never been liable to headachs. Severe pain in the loins; convulsions; ultimately insensibility.

72. Vessels of brain turgid. ℥iss of water in the lateral ventricles. Thalamus opticus of right side almost wholly occupied by a large tumour, extending to the neighbouring portion of corpus striatum.—*Symptoms.* The patient remained sensible till a few hours before his death.

73. Large apoplectic cyst immediately above left lateral ventricle. Surrounding cerebral substance unusually dense.—*Symptoms.* At the end of two years after an apoplectic fit, the patient committed suicide.

74. ℥j of coagulated blood in substance of right thalamus opticus. —*Symptoms.* Paralysis of left side; amaurosis; coma.

75. Layer of coagulable lymph over optic commissure, pineal gland, and tuber annulare.—*Symptoms.* Permanent contraction of the muscles on back of neck; dilatation of pupils; deafness.

76. Serous cyst imbedded in substance of right hemisphere.—*Symptoms.* Violent headachs; fits similar to those of apoplexy.

77. Tumour in left ventricle.—*Symptoms.* Epileptic fits; sore throat; great pain in deglutition.

78. Tumour compressing tuber annulare. Serum in lateral ventricles.—*Symptoms.* Stumbling in walking; mouth drawn to one side; loss of sight in one eye; pupils unaffected; dulness in hearing; difficulty in swallowing; died from inanition, with all the mental faculties unimpaired.

79. Purulent matter in cornu of right lateral ventricle.—*Symptoms* delirium; convulsions.

80. Purulent matter under tuber annulare.—*Symptoms.* Vomiting; delirium.

81. From ℥viii to ℥x of fluid and coagulated blood in lateral ventricles. Surfaces of corpora striata and thalami optici "torn up, lacerated, and destroyed.—*Symptoms.* Insensibility; loss of all muscular tone.

82. Considerable extravasation of blood into left corpus striatum, and extending into the substance of left anterior and posterior lobes. Aneurismal tumours on vertebral arteries at base of brain.—*Symptoms.* Apoplexy; no deficiency of power in the limbs.

83. Bones of cranium unusually thin. Several osseous spiculæ projecting inwards from posterior part of parietal bones. Substance of brain unusually soft. ℥viii or ℥x of fluid in ventricles. Thalami nervorum opticorum somewhat enlarged, irregular on surface, and entirely converted into fungous disease, resembling coagulated blood; affecting adjacent parts of cerebrum and cerebellum, and the lower and posterior edge of falx major. Optic nerves unusually dark in colour, but apparently unchanged in texture. Several sharp ridges of bone at base of skull.—*Symptoms.* Severe headach; pain usually referred to right temple, exacerbated every morning; vertigo; occasional syncope; dread of imaginary objects; great nervous irritation;

dulness of hearing; indistinct vision; occasional total blindness; quick pulse; heat of skin; violent pain in stomach; nausea; vomiting; severe metastatic pains; great emaciation; convulsions attended with strabismus, and followed by stupor; general paralysis; *Senses destroyed, excepting that of touch*; permanent dilatation of pupils. Gradually sunk. Disease of four years' duration. Patient, a female, æt. 21.

Base of Brain.

84. Tumour occupying third ventricle and posterior part of anterior crura of fornix, and compressing the optic nerves. A small tubercle between corpora quadrigemina. A small serous cyst situated towards the extremity of hippocampus minor.—*Symptoms.* Amaurosis; no headach; no paralysis; general muscular debility; memory and intellect impaired; delirium.

85. Three puriform points on right hemisphere. Substance of brain unusually vascular. Much serum in both lateral ventricles. Effusion of lymph on base of brain.—*Symptoms.* Delirium; right pupil contracted; left dilated; and both pupils insensible to the stimulus of light.

86. Large tumour at base of brain, attached to dura mater investing base of skull, compressing the pituitary gland, the middle lobe of left hemisphere, and the anterior portion of cerebellum. Partial absorption of these portions of cerebrum and cerebellum. Pituitary gland enlarged and displaced. The third, fourth, fifth, and sixth pairs of nerves obliterated at their origins.—*Symptoms.* Headach; vertigo; stupor; coma.

87. Aneurismal enlargement of both internal carotids, projecting into the cavernous sinuses.—*Symptoms.* Frequent attacks of mania, with consciousness of being insane. N. B. No other morbid appearance could be discovered in the encephalon.

88. Copious serous effusion on surface of brain, in ventricles, and at base of brain. A large tumour continuous with the Gasserian ganglion, pyriform, and compressing the anterior surface of tuber annulare. Ganglion itself hard, enlarged, flattened, and of an oval form. Vessels of base of brain turgid.—*Symptoms.* For many months subject to headach, confusion of sight, disorder of stomach, and vomiting. Was seized with an apoplectic fit; after which, his speech (which had immediately after the attack been lost) in some degree returned. Loss of vision. No power of volition in trunk or extremities. The patient enjoyed intervals during which the natural functions proceeded unimpaired. But after the lapse of two or three days of such periods, there always occurred palpitation, quick and irregular pulse, headach, pain and oppression in præcordia, and abdominal spasms, with bilious vomiting. In this state the patient lingered on for three or four months. Died apoplectic.—The appearances on dissection were the same as described in Case 85.

89. Enlargement of tuber annulare, especially on left side, compressing the fifth and seventh nerves against base of skull. Enlargement caused by a tumour of the size of a walnut occupying left side of tuber, and extending into left crus cerebelli.—*Symptoms.* Patient, a lady, attacked with fever and inflammation of brain, constant pain of head. These symptoms subsided, and hemiplegia of left side supervened. In the face, sensation and motion were lost. In the arm and leg sensation remained. Frequent attacks of erysipelas of face, confined to the side, deprived of sensation and motion. Complete deafness of left ear. In left side of tongue sensation lost, motion retained. Mucous membrane of right nostril pale. Several discharges of blood from mucous membrane of left nostril always of a deep red colour. Ophthalmia. Opacity and ulceration of cornea, followed by the discharge of the humours, and disorganization of ball of eye. *Intellect unimpaired.*

Cerebellum.

90. Three tumours of the size of nuts attached to left lobe of cerebellum.—*Symptoms.* Headach, and subsultus tendinum.

91. Right lobe of cerebellum in a state of ulceration.—*Symptoms.* Paraplegia of inferior extremities.

92. Almost the whole of right lobe of cerebellum occupied by an abscess containing about 2 oz. of thick pus.—*Symptoms.* Intense headach. Great prostration of strength.

93. Deposition of coagulable lymph on posterior edge of right lobe of cerebellum.—*Symptoms.* Tetanus.

94. Coagulum of blood under cerebellum.—*Symptoms.* Convulsions of neck and trunk, with drawing of feet upwards. No stupor.

95. Two ounces of serum under cerebellum.—*Symptoms.* Restlessness; convulsions; incessant talking; occasional incoherency; eyes insensible to light.

96. Pressure, by depression of skull, at sinciput.—*Symptoms.* Apathy; pain of head; delirium. From these, the patient, a male, partially recovered, but afterwards had much pain in the part affected. Animal spirits uncommonly high. Became "shameless in respect to every woman." Recovered by removing the cause of pressure.

97. Tumour imbedded in right lobe of cerebellum; ʒiij of fluid in lateral ventricles.—*Symptoms.* A convulsive fit, which deprived the patient of his speech, but *not of his intellect.*

98. Two abscesses in right lobe of cerebellum. Slight serous effusion between arachnoid and pia mater.—*Symptoms.* Patient retained his intellectual faculties unimpaired. Convulsions and coma for two hours previous to death.

99. Anterior surface of medulla oblongata covered by a copious effusion of lymph and purulent matter, so as to hide the basilar artery. Slight effusion of lymph on surface of cerebrum. Serous

effusion in ventricles, and between arachnoid and dura mater.—*Symptoms.* Violent pain of head; hemiplegia of left side; inability to void urine. Pain diffused over the whole body, and much aggravated by the slightest motion.

100. Considerable osseous deposition on tentorium. Hard tumour in substance of left lobe of cerebellum.—*Symptoms.* Patient sensible when spoken to; when not spoken to, in a state of coma or low muttering delirium. No paralysis. Pupils contracted.

Medulla oblongata.

101. Pressure on medulla oblongata by processus odontoides of vertebra dentata.—*Symptoms.* Complete paralysis of the whole body. Constant pain in back of neck.

102. Considerable effusion of blood on posterior surface of medulla oblongata. About ℥ij of lymph in left lateral ventricle.—*Symptoms.* The patient suddenly fell over in a state of insensibility. Respiration continued little changed for two days, when it stopped.

Of the Bloodvessels of the Brain.

The brain receives a large supply of blood by four arteries, called the INTERNAL CAROTID and VERTEBRAL ARTERIES.

The two former follow a tortuous course upon the rectus capitis anticus major muscle, before entering the carotid canal, and having passed through the above canal, are directed upwards; then turn horizontally; enter the cavernous sinus, and perforate the dura mater at the sides of the anterior clinoid processes of the sphenoid bone.

Each artery sends small *branches* to the dura mater, and to the cavernous sinus; and also gives off small *branches* which accompany the third, fourth, and fifth pairs of nerves.

When the internal carotid artery has perforated the dura mater, it sends off the OCULAR, or OPHTHALMIC ARTERY.

The other, and smaller branches of the internal carotid arteries, are distributed upon the optic nerve, the infundibulum, and the choroid plexuses.

There are two other large branches of the internal carotid artery, the arteriæ anteriores cerebri, and the arteriæ mediæ fossæ Sylvii.

The ARTERIÆ ANTERIORES CEREBRI, are disposed in a parallel manner in respect to each other: they run forwards along the under parts of the anterior lobes of the brain, and communicate by means of a transverse canal.

Each branch is afterwards subdivided into two branches: the smaller is spent entirely upon the anterior lobes of the brain; the larger is reflected backwards along the corpus callosum, and is divided into a great number of small branches, which anastomose repeatedly with the smaller branches of the former artery: many of the smaller branches supply the cortical and medullary part of the brain.

The ARTERIÆ MEDIÆ CEREBRI, or arteriæ mediæ fossæ Sylvii, are larger than the arteriæ anteriores. These arteries are lodged in the fossæ Sylvii, and extend obliquely outwards: their innumerable branches supply the middle and posterior lobes of the brain, and anastomose with the branches of the anterior arteries, and also with those of the vertebral arteries.

A few of the smaller branches of these arteries perforate the substance of the brain, supply the anterior cornua of the lateral ventricles, and also concur in forming the choroid plexuses.

The brain also receives blood by the medium of the vertebral branches of the subclavian artery.

The VERTEBRAL ARTERIES, after having entered the head,

detach large branches, which join with similar branches of the *anterior artery* of the brain, and form an *arterial circle* around the sella turcica, which has been named the ARTERIAL CIRCLE OF WILLIS.

Of the Veins which correspond with the Branches of the Internal Carotid and Vertebral Arteries.

The larger veins of the brain pass between the convolutions of that organ, and terminate in the *venous sinuses*, with their orifices directed obliquely forwards.

The veins of the dura mater accompany the arteries of that membrane, and terminate in the external or internal jugular vein; and a few of the veins open into the sinuses of the brain.

The uses of the structure described are, 1*st*, That when, by a sudden or violent action of the muscles of expiration, or of the muscles of the head and neck, the blood is repelled in the cavæ, or internal jugular veins, the impulse may not be communicated to the blood in the small and tender veins of the brain, which would endanger a rupture of these.

2*d*, The dura mater investing the trunks of the veins of the brain and cerebellum, evidently strengthens these, and prevents their being easily ruptured.

FINIS.

EXPLANATION OF PLATES.

PLATE FIRST.

THIS Plate represents the Human Cranium and Encephalon, cut perpendicularly at the right side of the Falx and Septum Lucidum.

AA Represents the section of the Cranium.

B, A section of the Right Frontal Sinus.

C, The forepart of the Falx, fixed to the Crista-Galli.

D, The back part of the Falx, fixed to the middle of the Tentorium E.

F, The upper and anterior part of the Cerebellum.

G, Part of the inner side of the Left Hemisphere of the Brain, with Arteries upon its surface from the Anterior Branch of the Internal Carotid Artery.

HH, A section of the Corpus Callosum.

II, The Septum Lucidum, between the Lateral Ventricles, in which there is no hole.

K, The middle part or body of the Fornix.

L, A section of the Right Posterior Crus of the Fornix.

M, A section of the Right Anterior Crus of the Fornix.

N, The Left Anterior Crus of the Fornix.

O, A section of the Anterior Commissura Cerebri.

P, The inner side of the Left Thalamus Nervi Optici, forming the Left Side of the Third Ventricle.

Q, A Vein running on the right side of the fore part of Septum Lucidum, and then across the forepart of the Body of the Fornix, to terminate in the Choroid Plexus, R, under the Body of the Fornix, to which the Choroid Plexuses of the two lateral Ventricles are united.

S, An Oval Hole, situated under the anterior part of the body of the Fornix; behind the Anterior Crura of the Fornix and Commissura Anterior Cerebri; on the forepart of the joining of the Choroid Plexuses of the two Lateral Ventricles of the Brain; and over the forepart of the Third Ventricle. Hence at this place, the Lateral Ventricles of the Brain communicate with each other and with the third ventricle.

T, The left Optic Nerve cut away from the Right at the place of their junction.

U, A Blind Sac in the left side of the Third Ventricle; under the Commissura Anterior, and between the continuation of the Corpus Callosum and the joining of the Left Optic Nerve with its Thalamus.

V, The Iter per Infundibulum ad Glandulam Pituitariam, between the joining of the Optic Nerves with their Thalami and the Corpora Albicantia; a section of the right one of which is represented at W.

X, A section of the Tuber Annulare.

Y, The Pineal Gland, fixed by a peduncle on each side to the Thalami Nervorum Opticorum, and by a middle peduncle to Z, the Commissura Cerebri Posterior.

a, The Nates of the right side cut.

b, The Testes of the right side cut.

c, The Iter a Tertio ad Quartum Ventriculum.

d, A section of the Right Internal Carotid Artery.

PLATE SECOND.

THIS Plate represents the Cranium and the Left Hemisphere of the Brain of the same subject; cut, first, perpendicularly, about the distance of a finger-breadth from the Falx, to such a depth as to lay open the Left Lateral Ventricle; and then cut, almost horizontally, from the Septum Lucidum and Left Ventricle, to the outer side of the Left Hemisphere of the Brain.

A, The Sagittal Suture of the Cranium.

BB, The cut edge of the top of the Cranium.

CC, An horizontal section of the Cranium.

DD, The left side of the Falx.

EE, The inner part of the Left Hemisphere, cut perpendicularly

e e, The outer part of the Left Hemisphere, cut almost horizontally.

FF, A perpendicular section of the Corpus Callosum.

G, The Septum Lucidum.

H, The middle part or body of the Fornix.

I, Part of the Anterior Cornu of the Lateral Ventricle.

K, The Posterior Cornu of the Lateral Ventricle.

L, The Left Pes Hippocampi.

M, A section of the Left Corpus Striatum.

N, A section of the Left Thalamus Nervi Optici.

O, The Choroid Plexus of the Left Ventricle.

R, Veins running on the forepart of the Septum Lucidum, which pass over Q, the Left Anterior Crus of the Fornix, to terminate where the choroid plexuses of the two ventricles are joined to the choroid plexus under the body of the fornix.

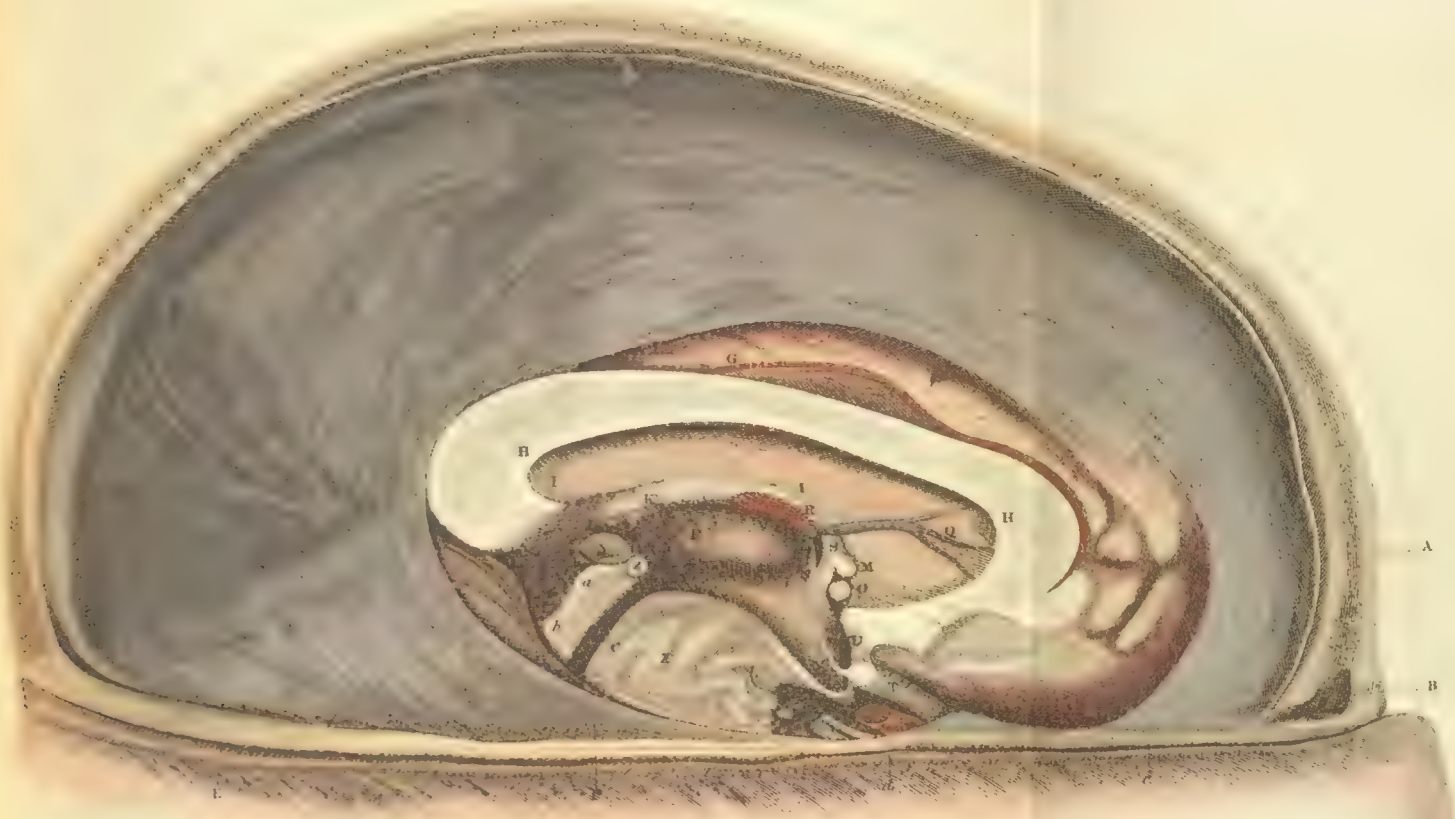
S, The Left Side of the Oval Hole or Passage by which the lateral ventricles communicate with each other and with the third ventricle.

PLATE THIRD.

Gives a very faithful view of the two Lateral Ventricles, of the fifth Ventricle, and also of the fourth.

The Lateral Ventricles were very considerably distended and distorted by a fluid, and, in a particular manner, the fifth Ventricle; and it may be observed that the walls of that ventricle were of a much firmer texture than usual; otherwise they could not have been extended in the manner which is represented in this Engraving, which is very faithful to nature, and which was taken from an excellent drawing by my late pupil Dr Charles Greville.

a, a, a, b, b, The hemispheres of the brain.
c, The anterior cornu of one of the lateral ventricles.
d, The posterior cornu of one of the lateral ventricles.
e, f, The distended portions of the lateral ventricles.
g, h, The corpora striata,
i, The tenia semicircularis.
k, Thalamus nervi optici.
l, Anterior part of the fornix.
m, The fifth ventricle, much enlarged.
n, A section of the cerebellum.
o, The fourth ventricle laid open.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TAB. II

A. Fyfe del.

PLATE III.